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HANDBOOK
MAINTENANCE INSTRUCTIONS

USAF SERIES
T-6G & LT-6G
AIRCRAFT

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INTRODUCTION

This handbook contains instructions for the accomplishment of line maintenance on the T-6G airframe, R-1340-AN-1 engine, and associated accessory equipment. Supplementary information on the operation, repair, and parts listing may be found in the following publications:

AN 01-60FFA-1	Handbook of Flight Operating Instructions
AN 01-60FFA-3	Handbook of Structural Repair
AN 01-60FFA-4	Parts Catalog
AN 01-60F-6	Handbook of Inspection Requirements

Section I of this Handbook contains general descriptive and dimensional data.

Section II is not included in this Handbook. Preservation and shipment procedures are covered by separate publications. Erection procedures are covered in Section IV.

Section III contains ground handling and servicing instructions, ground run-up procedures, lubrication information, and data on special airframe tools.

Section IV includes explicit information relative to description, installation and removal, adjustments, and testing of each system and/or components. Information on hydraulic or electrically operated equipment is included in the paragraphs covering the individual systems affected. For example, all descriptive hydraulic or electrical information relative to the operation of the landing gear, wing flaps, or surface control boost systems is included in the respective paragraphs. The hydraulic and electrical system paragraphs contain information on the basic power systems only.

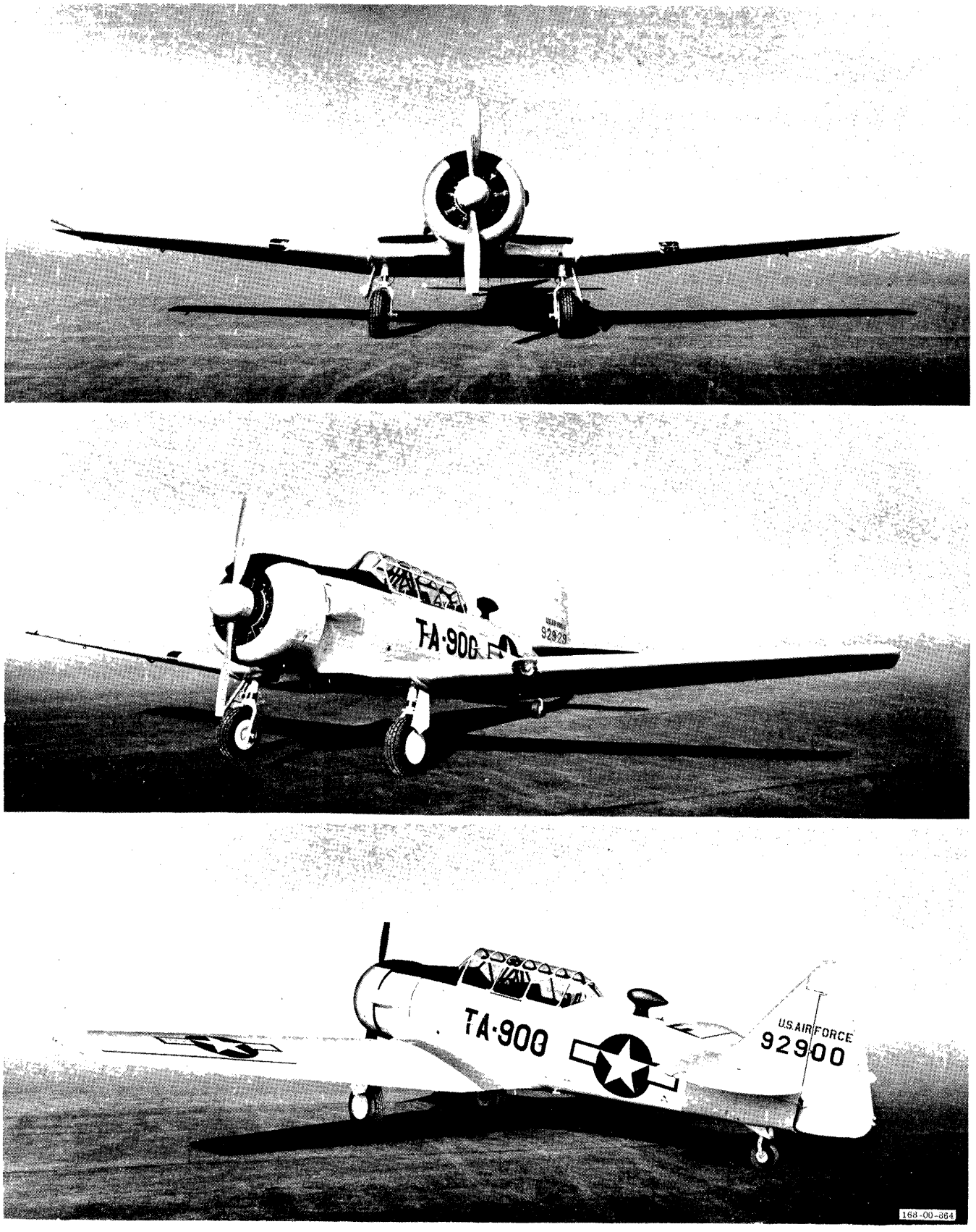
Section V is not included in this Handbook.

Section VI contains tabular chart data, and control rod and cable fabrication information.

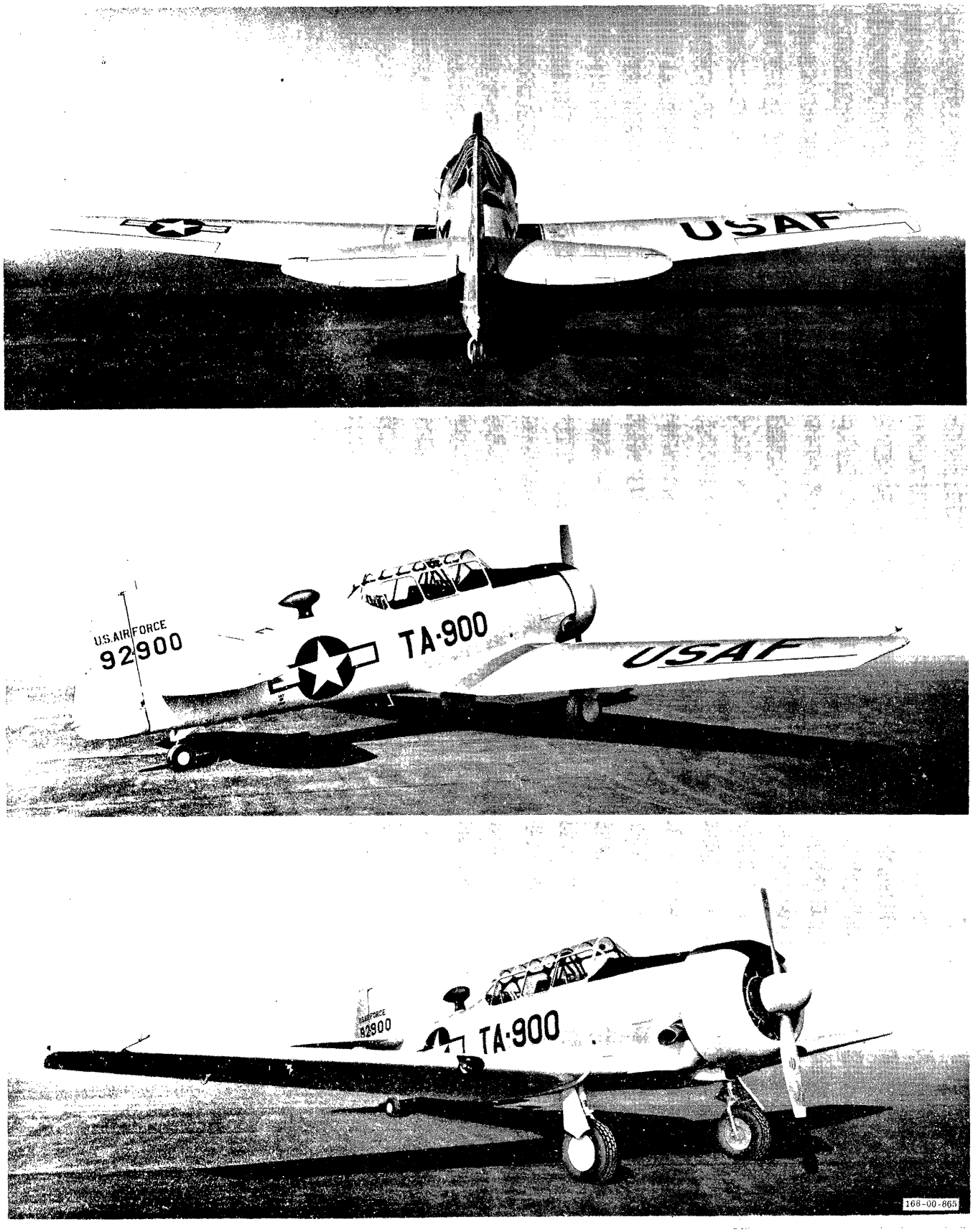
Section VII is not included in this Handbook. Inspection procedures for the airframe, engine, and components are covered by Handbook AN 01-60F-6.

Section VIII contains electrical and electronic schematic and isometric wiring diagrams, as well as relay and circuit breaker location diagrams.

The table of contents should be used to find the page numbers of sections and major paragraphs when general information is desired. The alphabetical index contains the page numbers of the principal text material and all illustrations.



Views of Airplane



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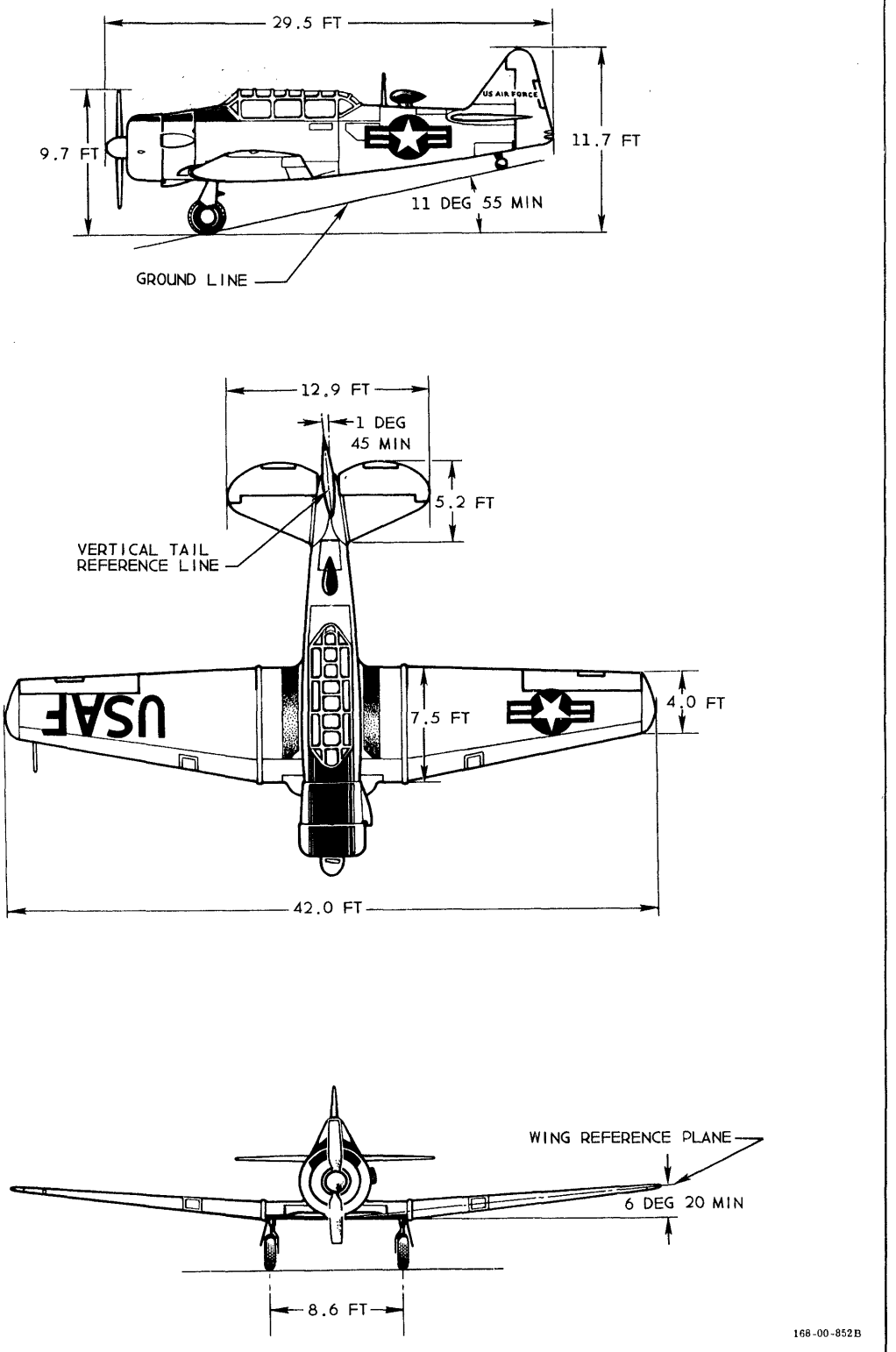


Figure 1-1. Principal Dimensions

SECTION I

DESCRIPTION, DIMENSIONS, AND LEADING PARTICULARS

1-1. DESCRIPTION.

1-2. The T-6G trainer airplane is a two-place, low-wing, single-engine monoplane, manufactured by North American Aviation, Inc. Power for operation of the airplane is obtained from a Pratt & Whitney nine-cylinder, air-cooled, radial engine. The engine turns a Hamilton Standard, two-bladed, constant-speed, counterweight-type propeller. The main landing gear is retractable, and the nonretracting tail wheel is steerable. Dual controls are installed in the tandem cockpits. Airplanes AF49-3538 through AF49-3596 are designated as LT-6G Airplanes, and are equipped to carry one .30-caliber machine gun on each wing, 2.25-inch SCA rockets, 5-inch HVA rockets, and bombs.

1-3. PRINCIPAL DIMENSIONS.

NOTE

Dimensions given are with fuselage reference line parallel to horizontal ground line unless otherwise noted.

GENERAL

Span	42.0 ft
Length	29.5 ft
Length (three-point position)	28.6 ft
Height	11.7 ft
Height (three-point position)	10.8 ft
Propeller ground clearance	1.3 ft

WING

Airfoil section - root	NACA 2215
- tip	NACA 4412
Chord - root	7.5 ft
- tip	4.0 ft
Incidence - root	2 deg
- tip	0 deg
Dihedral	6 deg 20 min
Sweepback (at wing leading edge)	10 deg 18 min 16 sec

STABILIZER

Span	12.9 ft
Chord (maximum theoretical projected)	5.2 ft
Incidence	1 deg
Dihedral	0 deg

FUSELAGE

Width (maximum)	3.9 ft
Height (maximum)	6.3 ft
Length (engine and rudder removed)	20.4 ft

AREAS

Wings (including ailerons)	253.7 sq ft
Ailerons (including tab)	each 11.4 sq ft
Aileron trim tabs	each 0.4 sq ft
Flaps - center section	11.4 sq ft
- outer wing	each 8.7 sq ft
Stabilizer (including area covered by fuselage)	28.3 sq ft

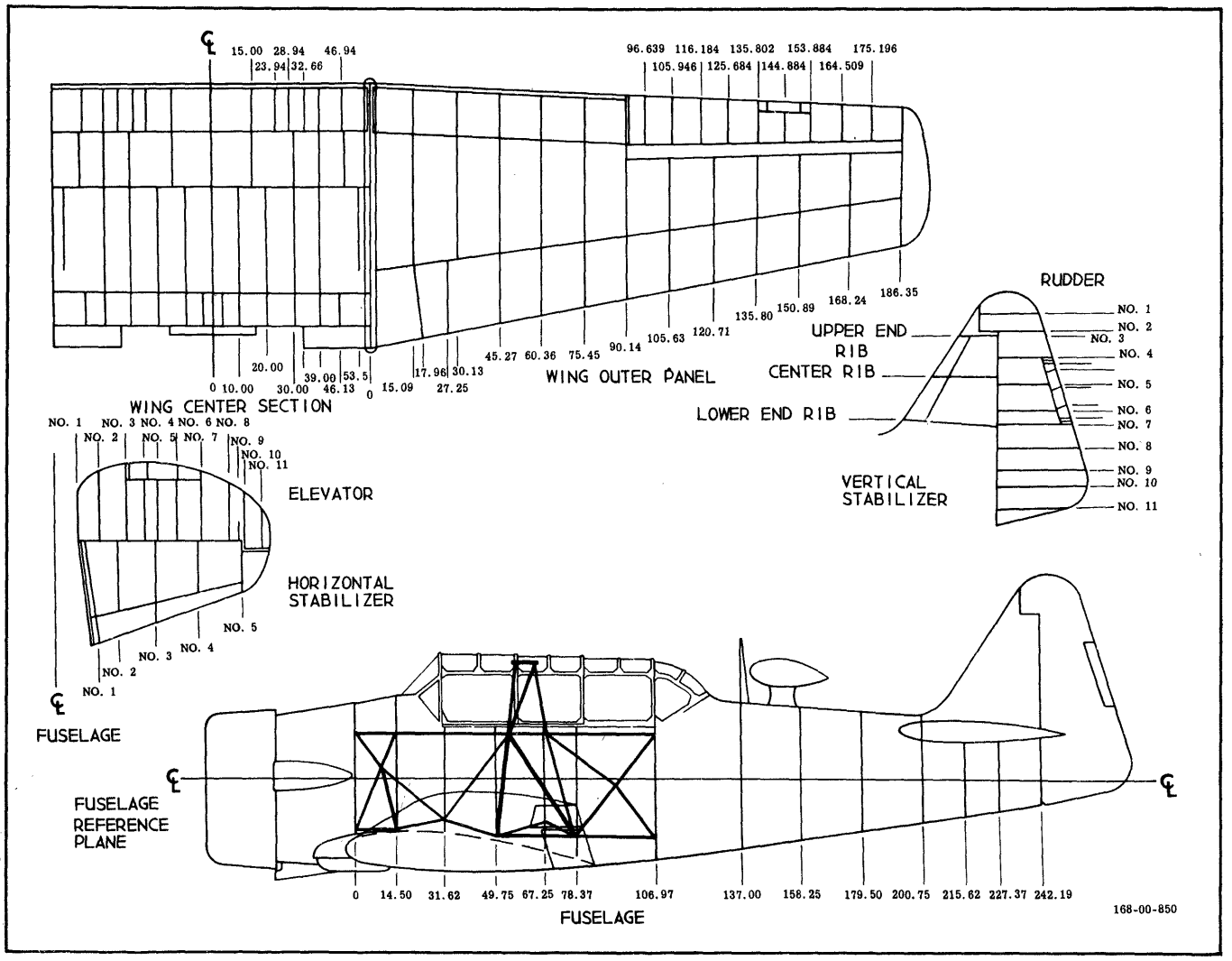


Figure 1-2. Airplane Stations

Elevators (including tabs)	each 10.9 sq ft
Elevator trim tabs	each 0.7 sq ft
Fin	5.3 sq ft
Rudder (including tab)	13.2 sq ft
Rudder trim tab	0.5 sq ft

1-4. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES AND FLAPS.

	DEGREES	INCHES	REFERENCE POINT	MOVEMENT TOLERANCE DEG	MOVEMENT TOLERANCE IN.
Ailerons - up	14	3-29/32	Inboard end of trailing edge	±1	±9/32
- down	16	4-15/32	Inboard end of trailing edge	±1	±9/32
Elevators - up	30	11-1/16	Trailing edge at outboard end of trim tab cutout	±1	±3/8
- down	20	7-7/16	Trailing edge at outboard end of trim tab cutout	±1	±3/8

	DEGREES	INCHES	REFERENCE POINT	MOVEMENT TOLERANCE DEG	MOVEMENT TOLERANCE IN.
Rudder - right	30	15-7/32	Trailing edge at greatest width	±1	±1/2
- left	30	15-7/32	Trailing edge at greatest width	±1	±1/2
Flaps - down	Approx 45	11-1/4	Wing trailing edge to bead forward of flap inboard trailing edge		
Trim tabs					
Aileron - up	(Ground adjustment only)				
- down					
Elevator - up	8	9/16	Inboard end of trailing edge	±1/2	±1/32
- down	16	1-3/32	Inboard end of trailing edge	±1/2	±1/32
Rudder - right	4	7/32	Lower trailing edge	±1/2	±1/32
- left	10	9/16	Lower trailing edge	±1/2	±1/32
Vertical Fin					
Offset	1 deg 45 min	1-1/8	Fin leading edge		

1-5. LEADING PARTICULARS.

MAIN LANDING GEAR
- Type . . . . . Hydraulically retractable
- Tread (between tire centers) . . . . . 8.6 ft
- Shock struts
  - Type . . . . . Air-oil
  - Maker and Model No. . . . . Bendix 65810 and 65811 (L & R)
  - Fluid required . . . . . Specification No. MIL-O-5606
  - Normal static extension . . . . . 1-1/2 in.
  - Air pressure (static) . . . . . Approximately 200 psi
- Wheels
  - Type and size . . . . . Type II drop-center, 27 in.
  - Maker and Model No. . . . . Hayes G-3-1A
- Tires
  - Type tread and size . . . . . All-weather, 8-ply, 27 in.
  - Inflation pressure . . . . . Approximately 32 psi
- Brakes
  - Maker and Model No. . . . . H2-584 L & R

TAIL WHEEL
- Type . . . . . Steerable nonretractable
- Shock strut
  - Type . . . . . Air-oil
  - Maker and Model No. . . . . Gladden 410356 or Bendix 53895
  - Fluid required. . . . . Specification No. MIL-O-5606
  - Normal static extension . . . . . 1-29/32 in.
  - Air pressure (static) . . . . . Approximately 160 psi
- Wheel
  - Size . . . . . 12.50 in.
  - Maker and Model No. . . . . Firestone - C0200
- Tire
  - Type tread and size . . . . . Channel-tread, static-conductor, 6-ply, 12.50 in.
  - Inflation pressure . . . . . 50 psi

ENGINE
- Manufacturer . . . . . Pratt & Whitney
- Designation R-1340-AN-1
- Gear ratio (engine crankshaft to propeller shaft) 1:1
- Blower ratio (blower speed to engine speed) 10:1
- Fuel . . . . . Specification No. MIL-F-5572, Grade 91/96
- Oil . . . . . Specification No. MIL-L-6082, Grade 1100

PROPELLER

Manufacturer	Hamilton Standard
Type	Two-bladed, constant-speed
Hub No.	12D40-211
Blade No. (2) (Airplanes AF49-2897 through AF49-3138)	6101A-20
Pitch settings	
Low	14.5 deg
High	29 deg
Diameter	8.3 ft
Blade No. (2) (Airplanes AF49-3139 and subsequent)	6101A-12, -13 or -14
Pitch settings	
Low	13 deg
High	28 deg
Diameter	9.0 ft

TANK CAPACITIES

Fuel	
Wing center section tanks (2)	Gal (each) 55.2 US. (46.0 Imp)
Outer wing panel tanks (2)	Gal (each) 15.0 US. (12.5 Imp)
Total internal fuel tank capacity	Gal 140.4 US. (117.0 Imp)
Droppable tank (Airplanes AF49-3538 through AF49-3596)	Gal 55.0 US. (45.8 Imp)
Oil	
Tank (1)	Gal 12.1 US. (10.1 Imp)
Expansion space	Gal 2.0 US. (1.7 Imp)
Total oil	Gal 10.1 US. (8.4 Imp)
Hydraulic fluid (1)	Gal 0.77 US. (0.64 Imp)

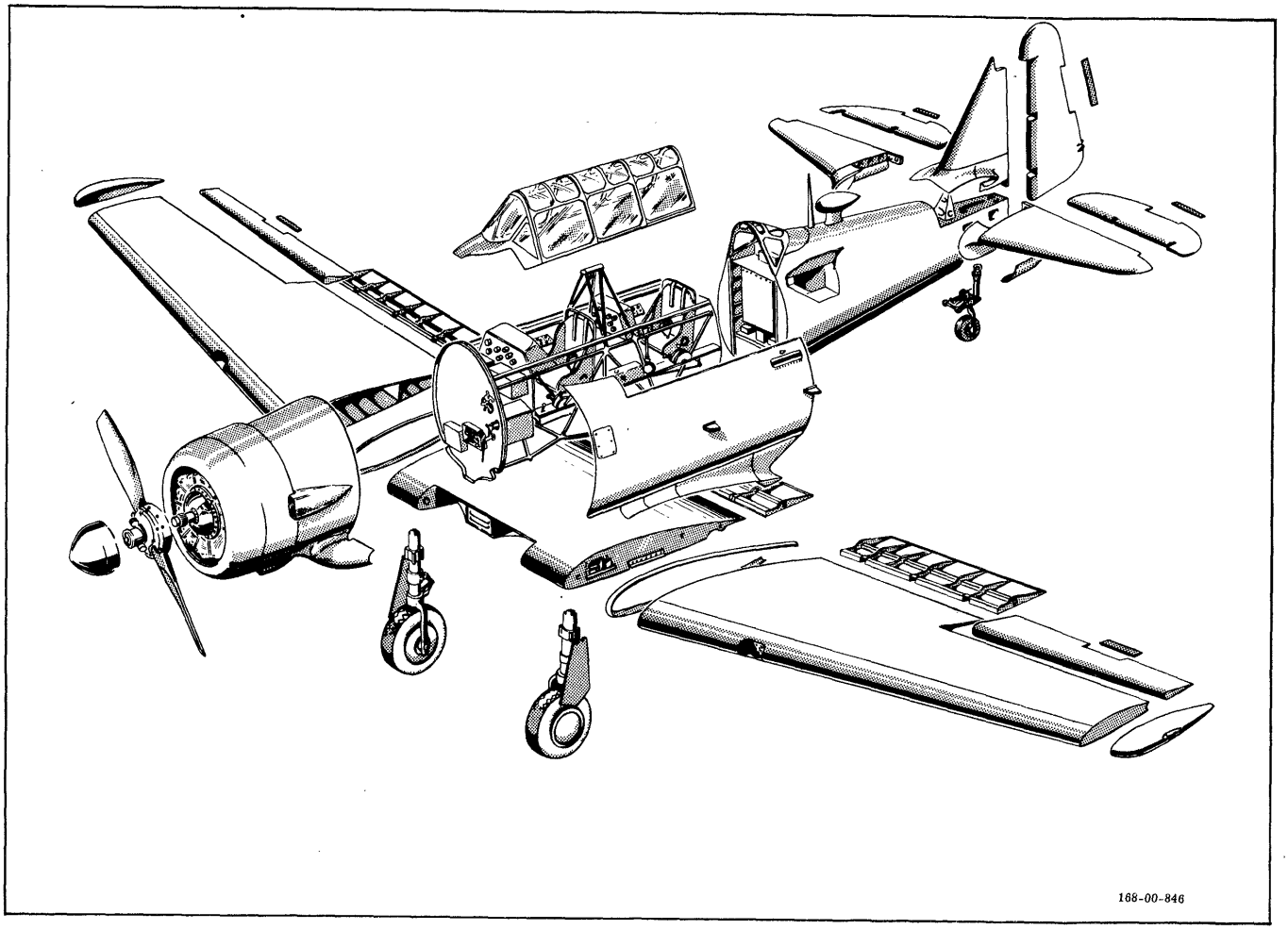


Figure 1-3. Exploded View of Airplane

SECTION II

SHIPMENT AND ERECTION PROCEDURE

SECTION III

GROUND HANDLING AND SERVICING INSTRUCTIONS

3-1. ACCESS AND INSPECTION PROVISIONS.

3-2. Access to either the front or rear cockpit is normally gained from the left side of the airplane. Two fixed steps on the left side of the fuselage and detents in the instrument panel shrouds provide steps and handholds for entrance and exit from either cockpit. A handhold just forward and to the left of the windshield and a retractable step in the left side of the engine cowling may be used when servicing the engine oil tank or when starting the engine manually. If the engine cowling is removed, the lower engine cowling formers may be used for steps. Do not use the windshield bow or the sliding enclosure for a handhold. Other access and inspection provisions are shown in figure 3-1.

3-3. GROUND HANDLING.

3-4. HOISTING.

3-5. Hoisting slings and attaching points are provided so that the complete airplane assembly, the complete fuselage assembly (with or without power plant installed), or the power plant may be hoisted. (See figures 3-2 and 3-3 for illustrations of the various slings in use.) For detailed information relative to the attachment and use of the hoisting slings, refer to that paragraph in section IV of this handbook concerning the assembly to be hoisted.

3-6. JACKING.

3-7. Permanent jacking points are provided on each main landing gear strut, on the front spar of each outer wing panel, and on the centerline of the fuselage near the tail wheel. Center section bolt angle pads (Part No. E-12) may be attached to the wing center section if it is desired to jack the airplane with the outer wing panels removed.

CAUTION

- Do not jack the airplane at the outer wing jacking points when the fuel tank doors are removed from the wing center section.
- When jacking the tail of the airplane with the power plant installed, insert the E-29 lift-mooring bar in the lift-mooring tube, and suspend sandbags or other suitable ballast (at least a total of 200 pounds) from the bar. This is to prevent the airplane from nosing over.

(See figure 3-4 for additional jacking information.)

3-8. LEVELING.

3-9. For location of the transverse and longitudinal leveling brackets, see figure 3-5. When leveling the airplane, the same precautions must be taken as when jacking the tail of the airplane. (Refer to CAUTION in paragraph 3-7.) Two datum points are provided on the lower centerline of the fuselage. One of these points is located just aft of the firewall; the other point is on the rear fuselage. Nut plates are installed at the two datum points for plumb bob attachment.

3-10. MOORING.

3-11. For location of mooring points and suggested method of mooring the airplane, see figure 3-6. Use the following procedure:

a. Head the tail of the airplane into the wind.

b. Lock surface controls, and chock wheels.

c. Insert 5R9 mooring rings into the sockets in the lower surface of the outer wing panels, near the wing tips.

d. Attach mooring lines or cables to mooring rings, and tie other ends to ground mooring points or suitable weights.

e. Secure the aft fuselage by passing a mooring line or cable through the lift-mooring tube, or by attaching the mooring line directly to the tail wheel strut.

3-12. SURFACE CONTROLS LOCK.

3-13. The surface control locking mechanism is located in the front cockpit, to the right and forward of the control stick. To lock the entire surface control system, place the rudder pedals in neutral, push the control stick forward, and center it laterally. Pull up and back on the lock handle assembly, and engage the control stick in the lock recess; then engage the handle plunger in the locked position. To release, push forward on the control handle, and then push the lock mechanism forward into the stowed

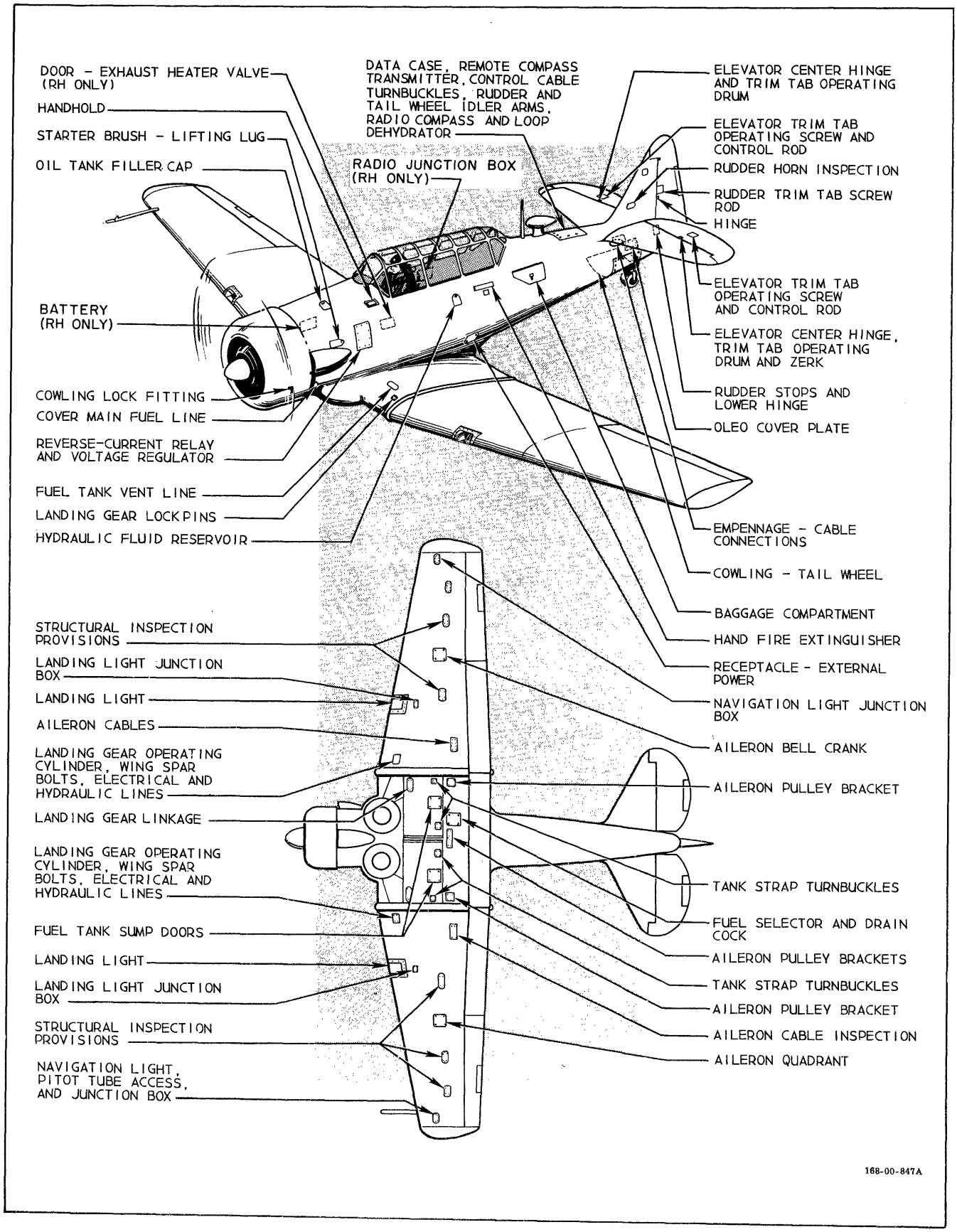


Figure 3-1. Access and Inspection Provisions

position. The lock mechanism should be stowed in the locked-down position when not engaged with the control stick.

3-14. PARKING BRAKES.

3-15. The parking brake control knob is located on a subpanel below the instrument panel in the front cockpit. To apply the parking brakes, press both brake pedals and pull out the control knob; then release the brakes and the control knob in that order. The parking brakes can be applied from the front cockpit only, but they can be released from either cockpit by pressing on the pedals.

3-16. TOWING.

3-17. For towing information, see figure 3-7.

CAUTION

Lock surface controls before towing airplane.

3-18. LOCKING BAGGAGE COMPARTMENT.

3-19. The baggage compartment may be locked by means of the lock in the door handle, the keys for which are stowed in the map and data case.

3-20. SERVICING.

3-21. Servicing points are shown in figure 3-8. Drain points are shown in figure 3-9.

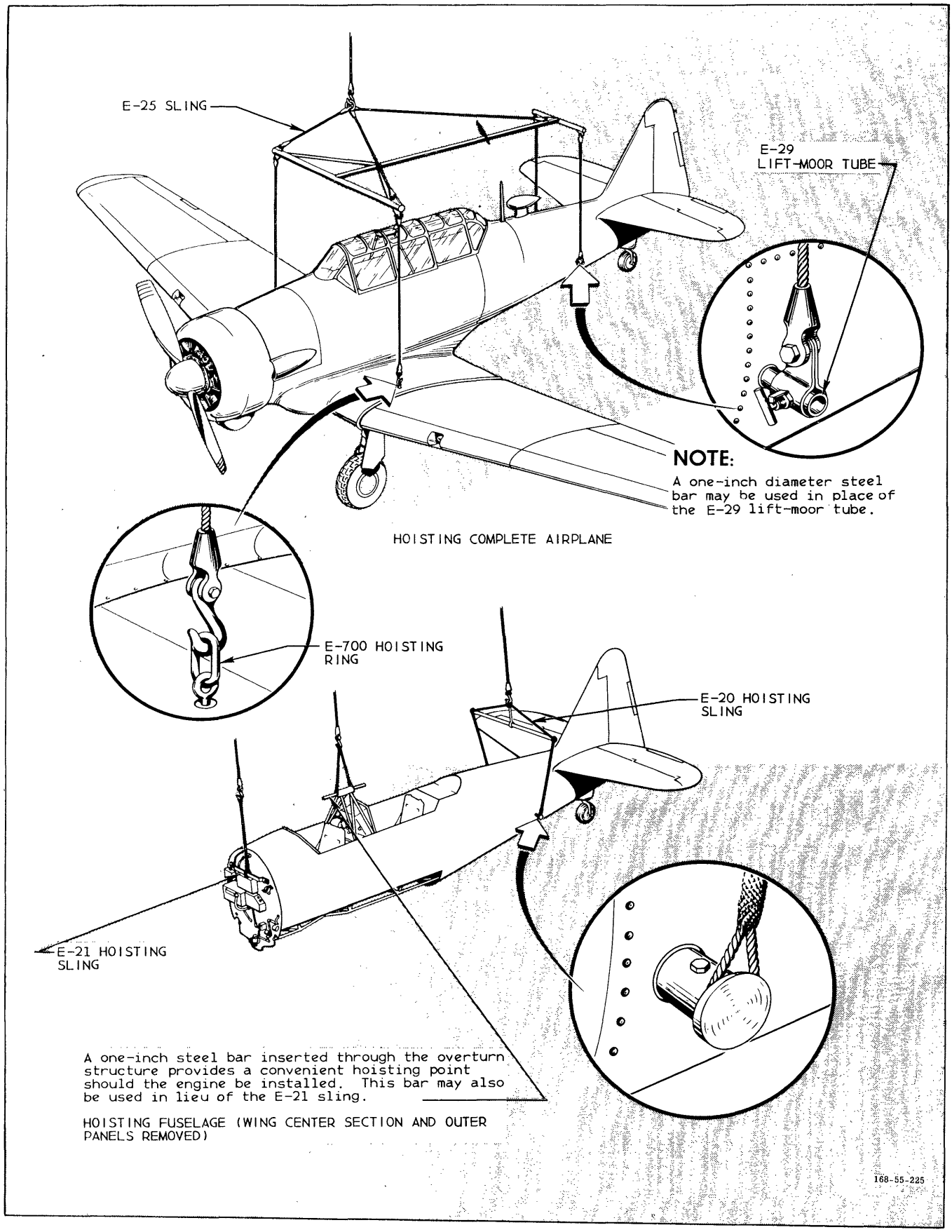


Figure 3-2. Fuselage Hoisting Slings

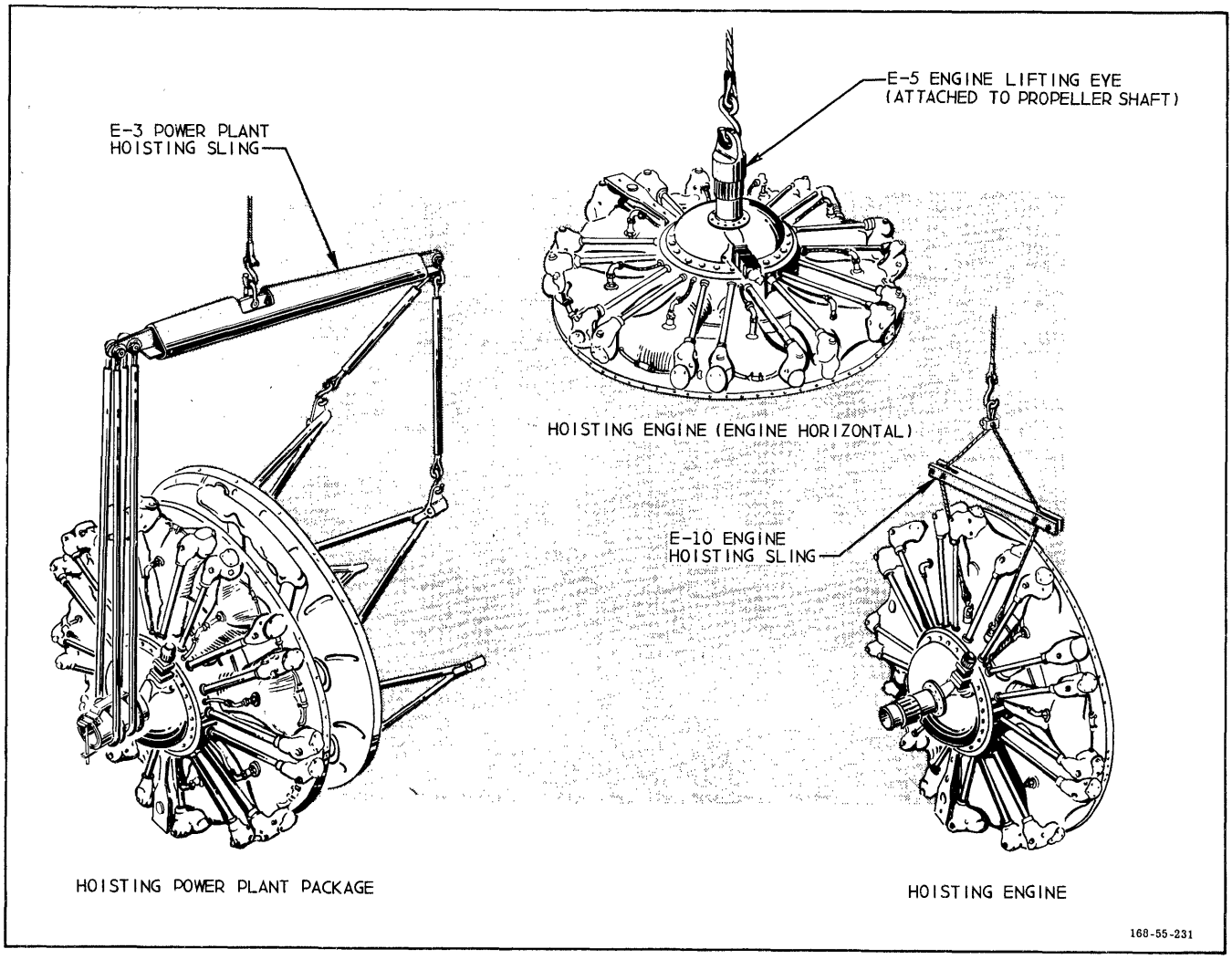


Figure 3-3. Engine Hoisting Slings

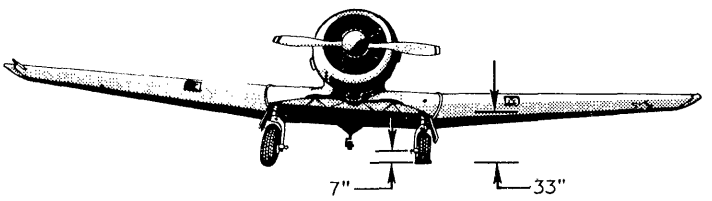
3-22. SERVICING FUEL SYSTEM.

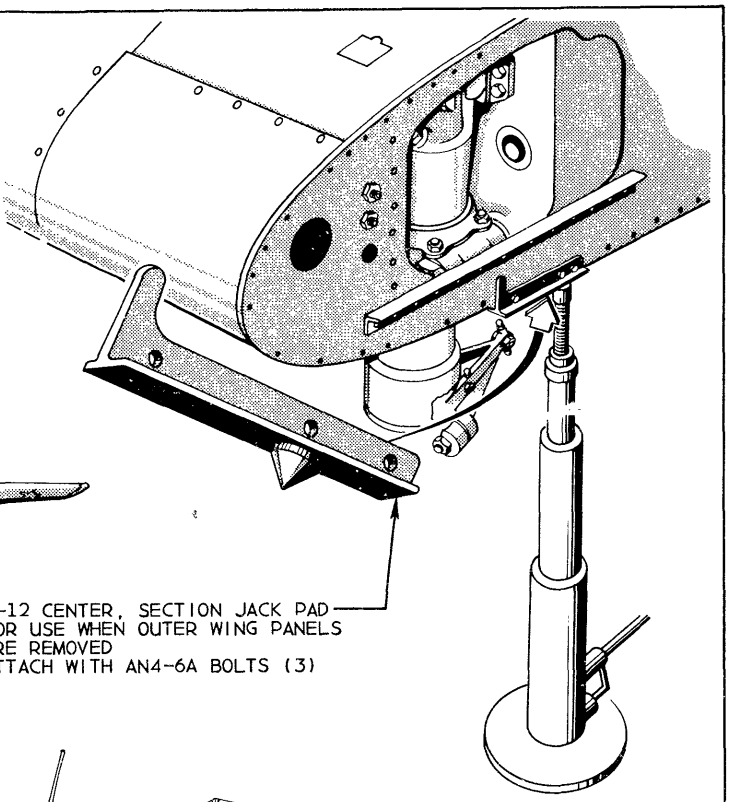
WARNING

Insofar as possible, fill and drain fuel tanks in the airplane out of doors, and take care to avoid spillage. Smoking is prohibited within 50 feet, and other sources of possible ignition, such as hobnail boots striking against concrete, must be avoided. When fuel trucks are employed, equip them with suitable static chains in contact with the ground or pavement. As an additional safety precaution, if the static chain has become fouled and has not recently touched the ground, dissipate any possible static charge which might have accumulated on the truck or trailer. An electrical charge is imparted to metal articles within the immediate vicinity of radar or high-frequency radio equipment in operation. This constitutes an extremely hazardous condition, since accumulation of the electrical charge from such sources may not be realized by personnel involved. Do not handle fuel within a radius of 75 feet of such equipment except during the shutdown period. In the event fuel must be handled in an emergency during an operating period, request radar operating personnel to remove the plate voltage from all radar transmitting equipment within a radius of 75 feet. Do not service the airplane with fuel while its radio or radar transmitting equipment is in operation.

3-23. Service the fuel system with fuel conforming

DIMENSIONS FROM GROUND TO WING AND AXLE JACK PADS WHEN ONE MAIN LANDING GEAR TIRE AND STRUT ARE DEFLATED

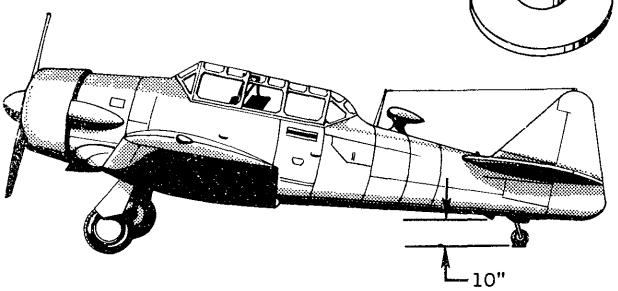




E-12 CENTER, SECTION JACK PAD
FOR USE WHEN OUTER WING PANELS
ARE REMOVED
ATTACH WITH AN4-6A BOLTS (3)

CAUTION:

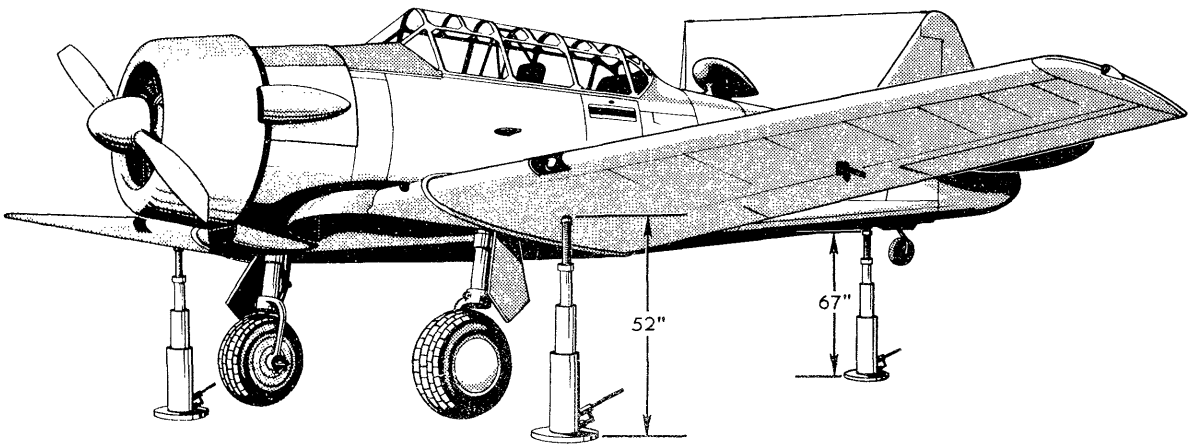
When jacking the airplane with power plant installed, attach weight of approximately 200 pounds at the lift-moor tube to prevent the airplane nosing over



DIMENSION FROM GROUND TO TAIL JACK PAD WHEN TAIL WHEEL TIRE AND STRUT ARE DEFLATED

WARNING:

Do not jack the airplane at the wing jacking points when the fuel tank doors are removed from the wing center section



DISTANCE FROM BOTTOM OF JACK PADS TO GROUND WHEN AIRPLANE IS IN LEVEL POSITION AND MAIN LANDING GEAR WHEELS ARE 2 INCHES OFF GROUND

168-55-230

Figure 3-4. Jacking Diagram

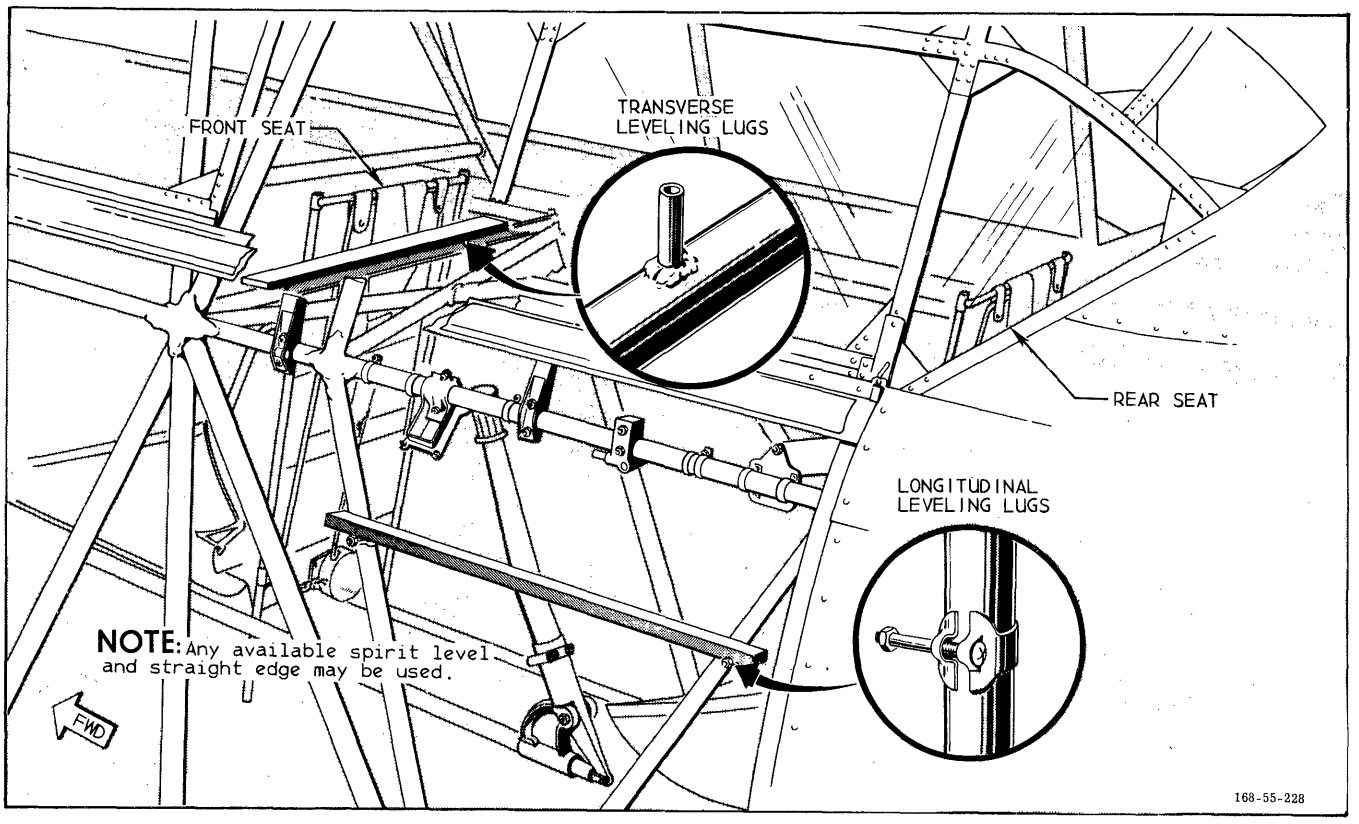


Figure 3-5. Leveling Provisions

to Specification No. MIL-F-5572, Grade 91/96. The capacities of the fuel tanks are given in paragraph 1-5.

3-23A. FILTERING FUEL. The use of filters in funnels for filtering airplane fuel into tanks of the airplane will usually be unnecessary. If, however, presence of dirt in the fuel indicates that emergency filtering is required, use a chamois skin for this purpose. To eliminate the fire hazard that is involved when filtering volatile, flammable liquid through chamois, observe the following precautions:

a. Attach the chamois securely to the funnel.

b. Keep the funnel in contact with the metal of the tank or other receptacle to provide a good electrical ground at all times during the process of filtering. In addition, bond the delivery hose to the airplane or tank.

c. Never tie the chamois skin over the end of the discharge nozzle, and never use it in any manner that will cause the fuel to pass through the chamois under pressure.

3-23B. GROUNDING HOSE NOZZLE. Permanently attach one end of a flexible bonding wire of suitable length to the discharge nozzle of the fuel delivery hose. On the other end, install a plug and a standard test clip prior to delivery of any fuel to the fuel tank of the airplane. Insert the plug into the receptacle installed on the airplane for ground purposes, or attach the standard test clips to an uninsulated metallic part of the airplane to ensure an electrical bond between the tank and delivery hose. Do not attach the bonding wire to the filler neck of the tank, but to the bare metal of the airplane. This electrical bond must always be effected before removal of the filler cap and must be left connected until the filler cap has been replaced.

3-24. FILLING FUEL TANKS. Use the following procedure when filling the fuel tanks:

a. Examine visible components of fuel system for leaks.

b. Ground the airplane to the refueling unit. Grounding jack receptacles are located near the fuel filler openings.

c. Drain a small quantity of fuel from each of the fuel system drain cocks, and examine fuel for presence of water or foreign material. If water or foreign material is present, the drain cock should be left open until all water or foreign material is removed.

d. Fill the fuel tanks to overflowing. Do not refer to the fuel tank gages, as they are correct only when the airplane is in the level flight position.

e. Install filler cap.

f. Wipe away any spilled fuel.

g. Recheck fuel system drain cocks for presence of water or foreign material.

3-24A. FILLING DROPPABLE FUEL TANK. Airplanes AF49-3538 through AF49-3596 have provisions for carrying an external droppable fuel tank under the wing center section. To service the tank, remove the filler cap in the top forward portion of the tank and fill to a capacity of 55 gallons. Install filler cap and wipe away any spilled fuel.

3-24B. DRAINING DROPPABLE FUEL TANK. The droppable fuel tank is drained by opening the drain valve on the lower aft part of the tank.

3-25. DRAINING FUEL SYSTEM. To drain the fuel system, open the sump drain cock on the fuel selector valve. Drain the residual fuel in the wing tanks by opening the four sump drain cocks. Drain the fuel filter by opening the drain cock on the bottom of the filter.

3-26. SERVICING ENGINE OIL SYSTEM.

3-27. The engine oil tank is located on the top forward side of the engine firewall. Access to the oil tank filler cap is through a dzus-fastened access door in the upper left section of the engine compartment cowling. Service the engine oil system with oil conforming to Specification No. MIL-O-6082, Grade 1100. (Refer to paragraph 1-5 for capacity of engine oil tank.)

3-28. FILLING ENGINE OIL TANK. Open access door in cowling, and remove filler cap. Add oil as necessary to fill the tank to the bottom of the filler neck. Install filler cap, and close access door.

3-29. DRAINING ENGINE OIL SYSTEM. To drain the oil system completely, it is necessary to remove the lower right section of the engine compartment cowling. Place a suitable receptacle under the oil drain line, and open the "Y" drain valve, located on the right side of the engine compartment. Open the oil tank sump drain cock to remove residual oil.

3-30. SERVICING HYDRAULIC SYSTEM.

3-31. The hydraulic system reservoir is located on the left side of the fuselage, midway between the cockpits. Access to the reservoir is through a dzus-fastened door. An instruction plate for filling the

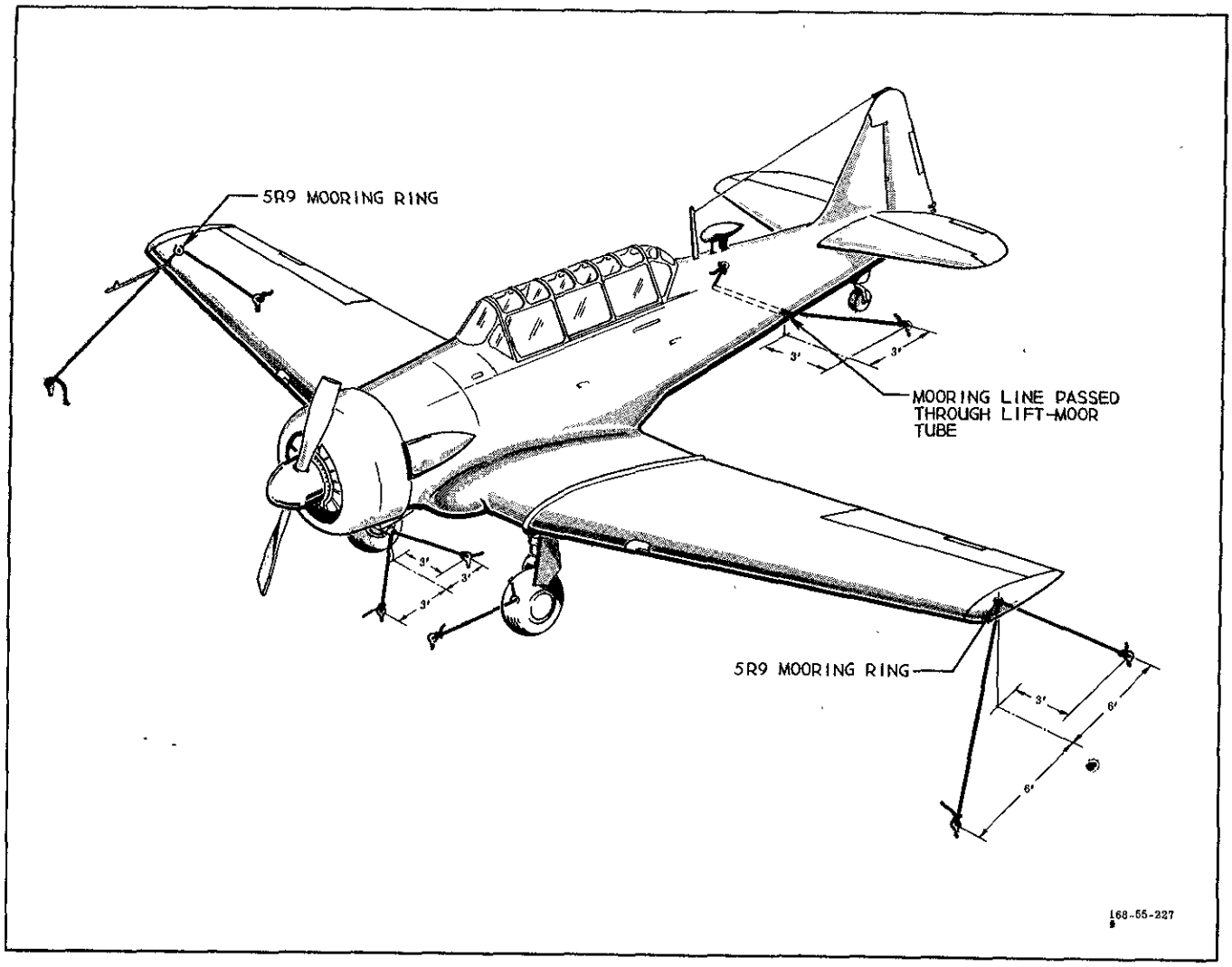


Figure 3-6. Mooring Diagram

reservoir is located on the inside of this door. (Refer to paragraph 1-5 for capacity of hydraulic system reservoir.) Service the hydraulic system with hydraulic fluid conforming to Specification No. AN-O-366.

3-32. REPLENISHING FLUID IN HYDRAULIC SYSTEM RESERVOIR. Open access door inside of fuselage, and remove the filler cap. With the airplane in the three-point position, fill the reservoir to overflowing. Replace filler cap, and close access door.

3-33. DRAINING HYDRAULIC SYSTEM. Complete drainage of the hydraulic system cannot be accomplished from any one point. However, to remove a considerable portion of the fluid (mainly that contained in the reservoir), place the tail of the airplane slightly above the level flight position, and disconnect the aft line of the lower test pump connection block mounted on the left side of the engine mount. Approximately 1/2 gallon of fluid will be obtained from this point. With the landing gear control handle in the "DOWN" position, further drainage may be accomplished by placing a receptacle under the drain "T" fitting on the landing gear hydraulic line, located in the left landing gear wheel well, and removing the cap on the "T" fitting. Operating the hand-pump will then cause the remaining fluid to be removed.

3-34. SERVICING MAIN LANDING GEAR TIRES.

3-35. INFLATING MAIN LANDING GEAR TIRES. Access to the inflating valve is gained by removing the outside wheel fairing. This fairing is held in place by means of dzus fasteners. Inflate the main landing gear tires to 32 psi.

3-36. SERVICING MAIN LANDING GEAR SHOCK STRUTS.

3-37. Access to the air filler valve and fluid filler plug of each strut is through an access cover located on the upper surface of the wing center section, directly above the strut. Service the struts with fluid conforming to Specification No. AN-O-366.

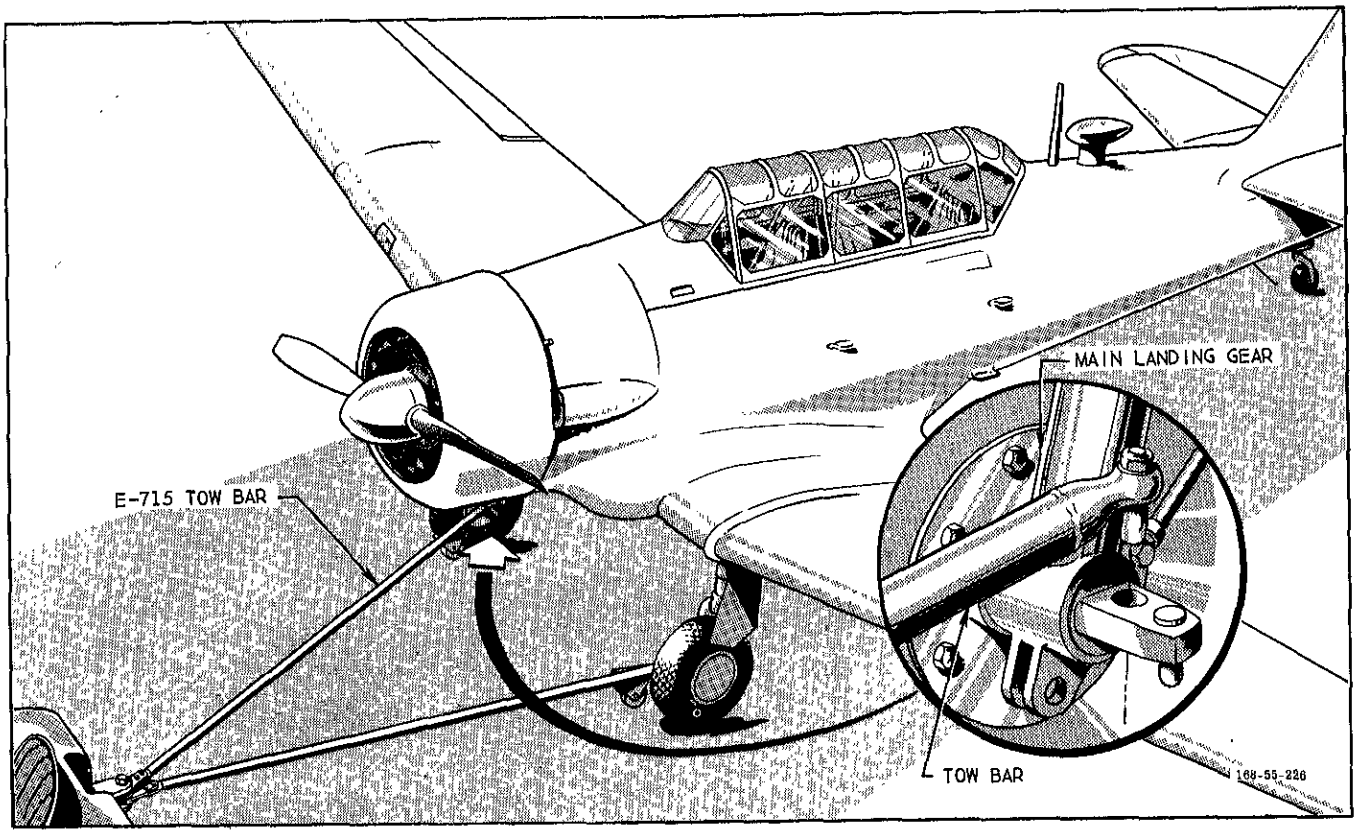


Figure 3-7. Towing

3-38. DEFLATING MAIN LANDING GEAR SHOCK STRUTS. The main landing gear shock struts may be deflated as follows:

a. Remove shock strut access cover.

b. Slowly release all air from strut by backing off the filler plug not more than one full turn. Do not completely remove the filler plug until all fizzing of air and fluid stops and the strut is fully compressed.

3-39. FILLING MAIN LANDING GEAR SHOCK STRUTS. Fill the main landing gear shock struts as follows:

a. Deflate the shock strut, using procedure given in paragraph 3-38.

b. Remove filler plug from strut, and check fluid level.

c. Add fluid as necessary to bring level of fluid even with filler plug hole.

d. Replace filler plug loosely, and cause strut to extend and compress several times to remove any air traps.

e. Remove filler plug, and check fluid level. Repeat steps c. and d. until proper fluid level is obtained.

f. Install filler plug, and tighten securely.

3-40. INFLATING MAIN LANDING GEAR SHOCK STRUTS. With the airplane fully loaded and resting on its landing gear, inflate the main landing gear shock struts as follows:

a. Remove air filler valve cap.

b. Attach air pressure supply hose to filler valve, and inflate strut until approximately 1-1/2 inches of the polished piston can be seen between the packing nut and strut piston shoulder. While inflating the strut, rock the airplane occasionally to overcome packing friction.

c. Remove air pressure supply hose, and install air filler valve cap.

d. Check strut for any air or fluid leaks.

3-41. SERVICING TAIL WHEEL TIRE.

3-42. INFLATING TAIL WHEEL TIRE. Inflate the tail wheel tire to 50 psi.

3-43. SERVICING TAIL WHEEL SHOCK STRUT.

3-44. Access to the tail wheel shock strut filler plug is gained through an access plate on the left side of the airplane, near the tail. Service the strut with hydraulic fluid conforming to Specification No. AN-O-366.

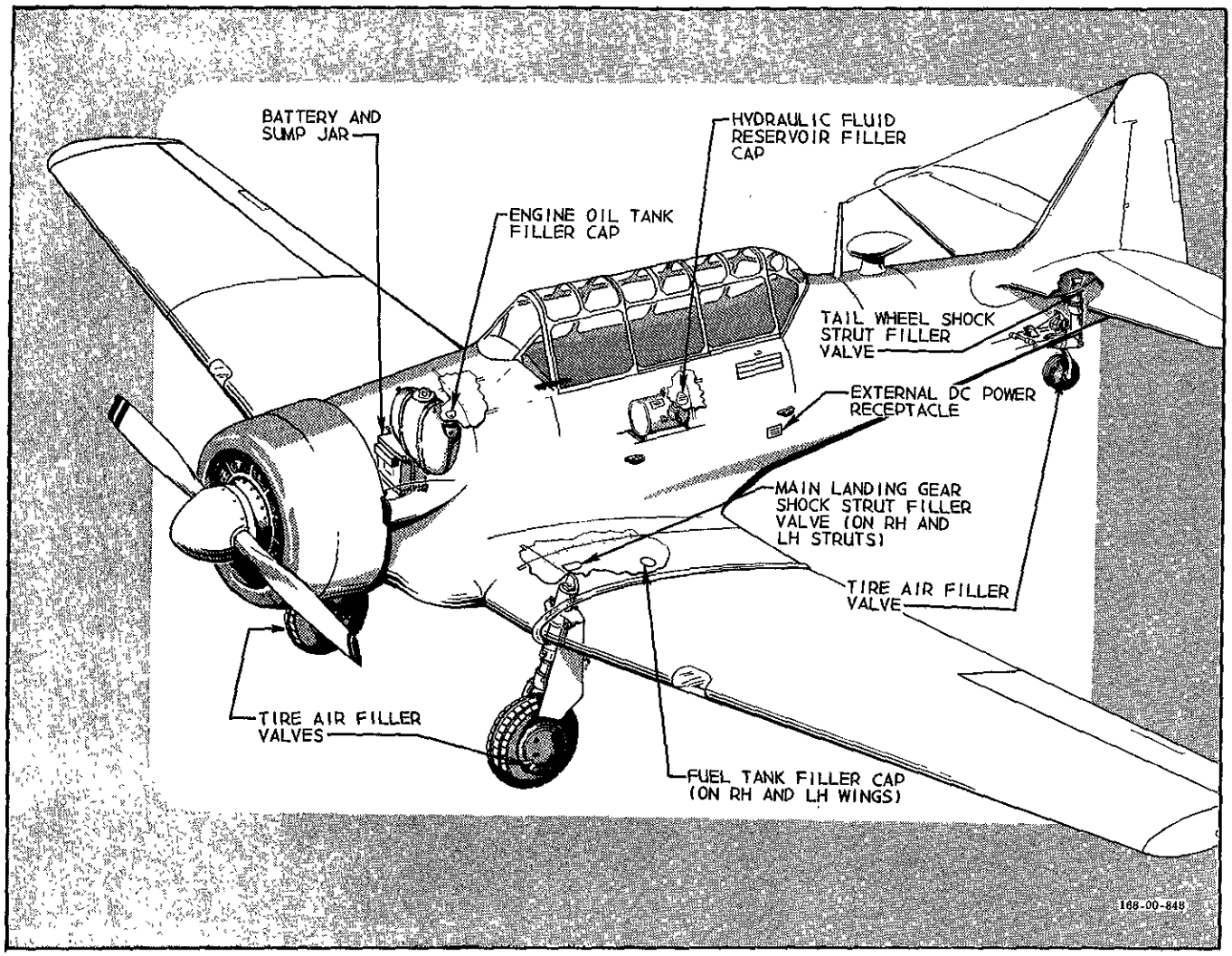


Figure 3-8. Servicing Diagram

3-45. DEFLATING TAIL WHEEL SHOCK STRUT. The tail wheel shock strut may be deflated as follows:

a. Remove tail wheel shock strut access plate.

b. Slowly release all air from the strut by loosening the filler plug not more than one complete turn. Do not completely remove the filler plug until all fizzing of air and fluid stops, and the strut is fully compressed.

3-46. FILLING TAIL WHEEL SHOCK STRUT. Fill the tail wheel shock strut with fluid as follows:

a. Deflate shock strut, using procedure given in paragraph 3-45.

b. Remove filler plug, and check fluid level.

c. Add fluid as necessary to bring level of fluid even with filler hole.

d. Install filler plug loosely, and cause strut to extend and compress several times to eliminate air traps in the strut.

e. Remove filler plug from strut, and check fluid level. Repeat steps c. and d. until proper fluid level is obtained.

f. Install filler plug, and tighten securely.

3-47. INFLATING TAIL WHEEL SHOCK STRUT. Inflate the tail wheel shock strut as follows:

a. Remove valve cap from air filler valve.

b. Attach air pressure supply hose to air filler valve, and inflate strut until red line on tail wheel strut fairing is even with the lower edge of the fuselage rear cowl. This results in approximately 1-29/32 inch strut inflation.

c. Remove air pressure supply hose, and install air filler valve cap.

d. Check strut for any air or fluid leaks.

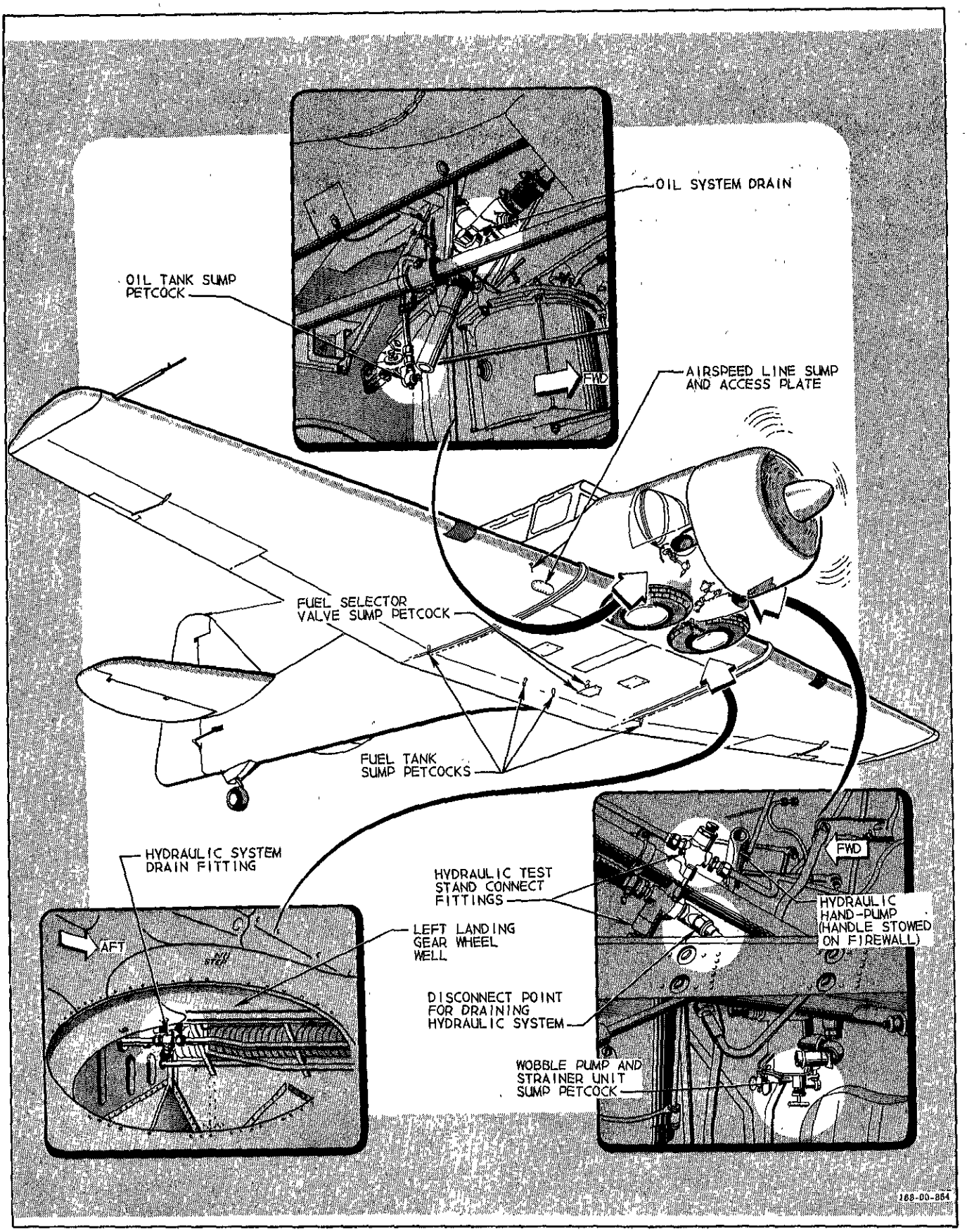


Figure 3-9. Draining Diagram

3-48. SERVICING BATTERY.

3-49. The battery is located on the right forward side of the engine firewall. Access to the battery is gained through an access door located in the top right section of the engine compartment cowling. On Airplanes AF49-2947 and subsequent, access to the battery may be made through the fire extinguisher door on the right-hand side of the engine accessory cowling.

3-50. BATTERY SPECIFIC GRAVITY. The specific gravity of a fully charged battery should be in the range of 1.275 to 1.300. If the specific gravity of the battery is below 1.240 or above 1.310, or if the specific gravity reading of any of the cells differs by more than 0.020, replace the battery.

3-51. FILLING BATTERY. When it is necessary to add water to the battery, use distilled or clean drinking water. To add water to a cell, fill a self-leveling syringe with water and insert it into the cell. Hold syringe in vertical position, and fill the cell. Then withdraw excess water into syringe until air is sucked in, which leaves the electrolyte at the proper level.

NOTE

During cold weather the battery must be kept as near full charge as possible or the electrolyte will freeze. The battery should be removed and stored in a warm place when the airplane is to be parked for more than four hours at temperatures below -29°C (-20°F) or for any extended period.

CAUTION

Avoid spilling any electrolyte on the airplane structure or equipment. Should this occur, immediately neutralize the affected area with a water solution of sodium bicarbonate.

3-52. SERVICING BATTERY SUMP JAR.

3-53. The battery sump jar is located against the engine compartment firewall, immediately below the battery. To service the sump jar, inspect the felt pad in the jar for condition. If the felt pad is dry, saturate it with a solution of trisodium phosphate.

3-54. GROUND OPERATING INSTRUCTIONS.

3-55. For ground and preflight check and other related information, refer to Pilot's Handbook.

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3-72. LUBRICATION REQUIREMENTS.

3-73. Parts and mechanisms requiring periodic lubrication are shown in figure 3-10. Specialized lubrication requirements of instruments, electronic equipment, engines, and engine accessories are not included in the lubrication chart.

3-74. SPECIAL TOOLS AND GROUND HANDLING EQUIPMENT.

3-75. The following listed special tools and ground

handling equipment are used in the servicing and maintenance of the airplane.

E-700	Hoisting rings
E-29	Lift-mooring tube
E-3	Sling - engine and mount hoisting
E-5	Engine lifting eye
E-10	Sling - engine hoisting
E-12	Jack pad - wing center section
E-21	Sling - fuselage hoisting
E-25	Sling - airplane hoisting
E-715	Tow bar
E-20	Sling - fuselage hoisting
5R9	Mooring rings

3-76. AIRPLANE MARKINGS.

3-77. Airplane markings are shown in figure 3-11. Use lacquer conforming to Specification No. AN-L-29 to maintain the stenciled markings.

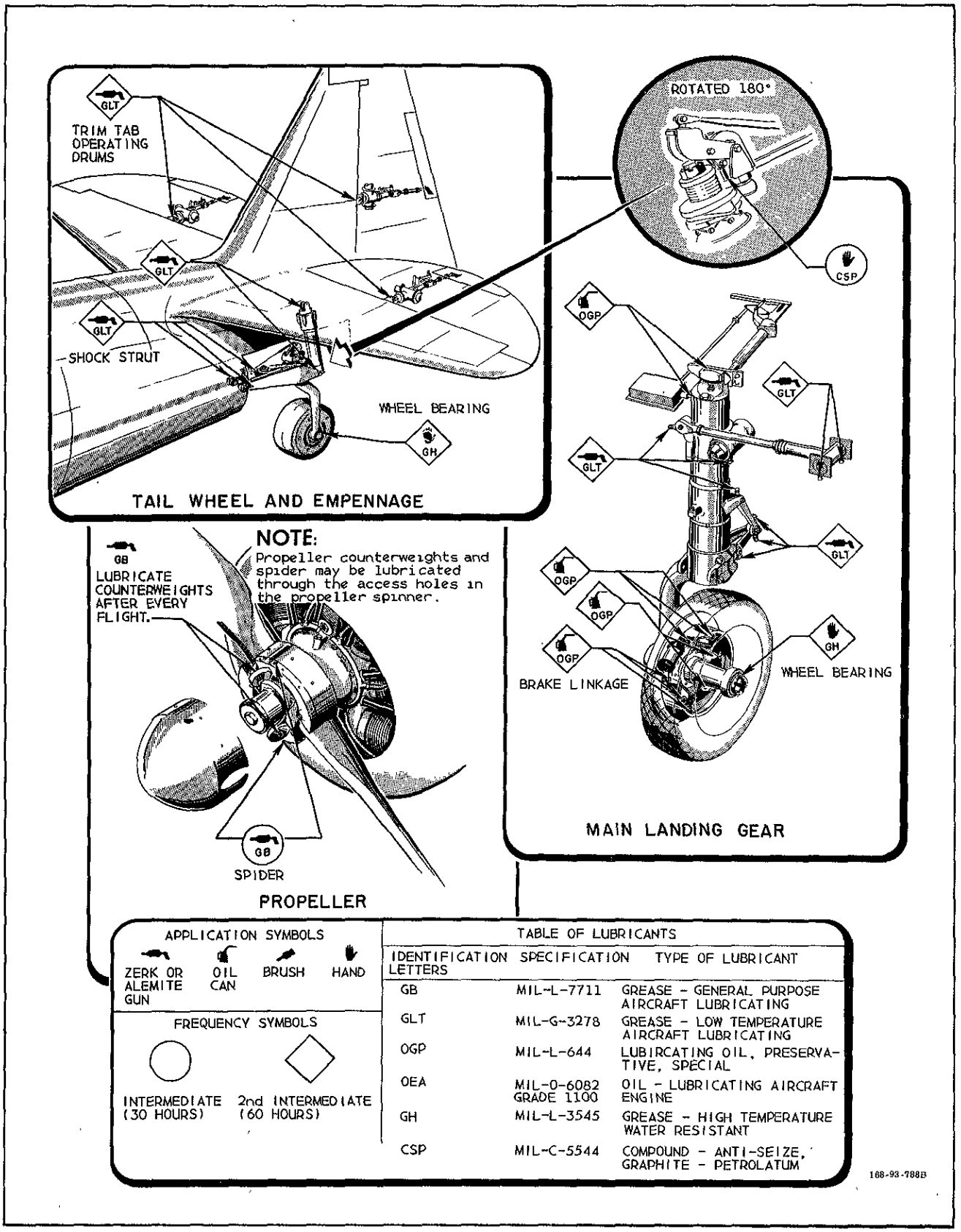


TABLE OF LUBRICANTS

IDENTIFICATION LETTERS	SPECIFICATION	TYPE OF LUBRICANT
GB	MIL-L-7711	GREASE - GENERAL PURPOSE AIRCRAFT LUBRICATING
GLT	MIL-G-3278	GREASE - LOW TEMPERATURE AIRCRAFT LUBRICATING
OGP	MIL-L-644	LUBIRCATING OIL, PRESERVATIVE, SPECIAL
OEA	MIL-O-6082 GRADE 1100	OIL - LUBRICATING AIRCRAFT ENGINE
GH	MIL-L-3545	GREASE - HIGH TEMPERATURE WATER RESISTANT
CSP	MIL-C-5544	COMPOUND - ANTI-SEIZE, GRAPHITE - PETROLATUM

Figure 3-10 (Sheet 1 of 3 Sheets). Lubrication Chart

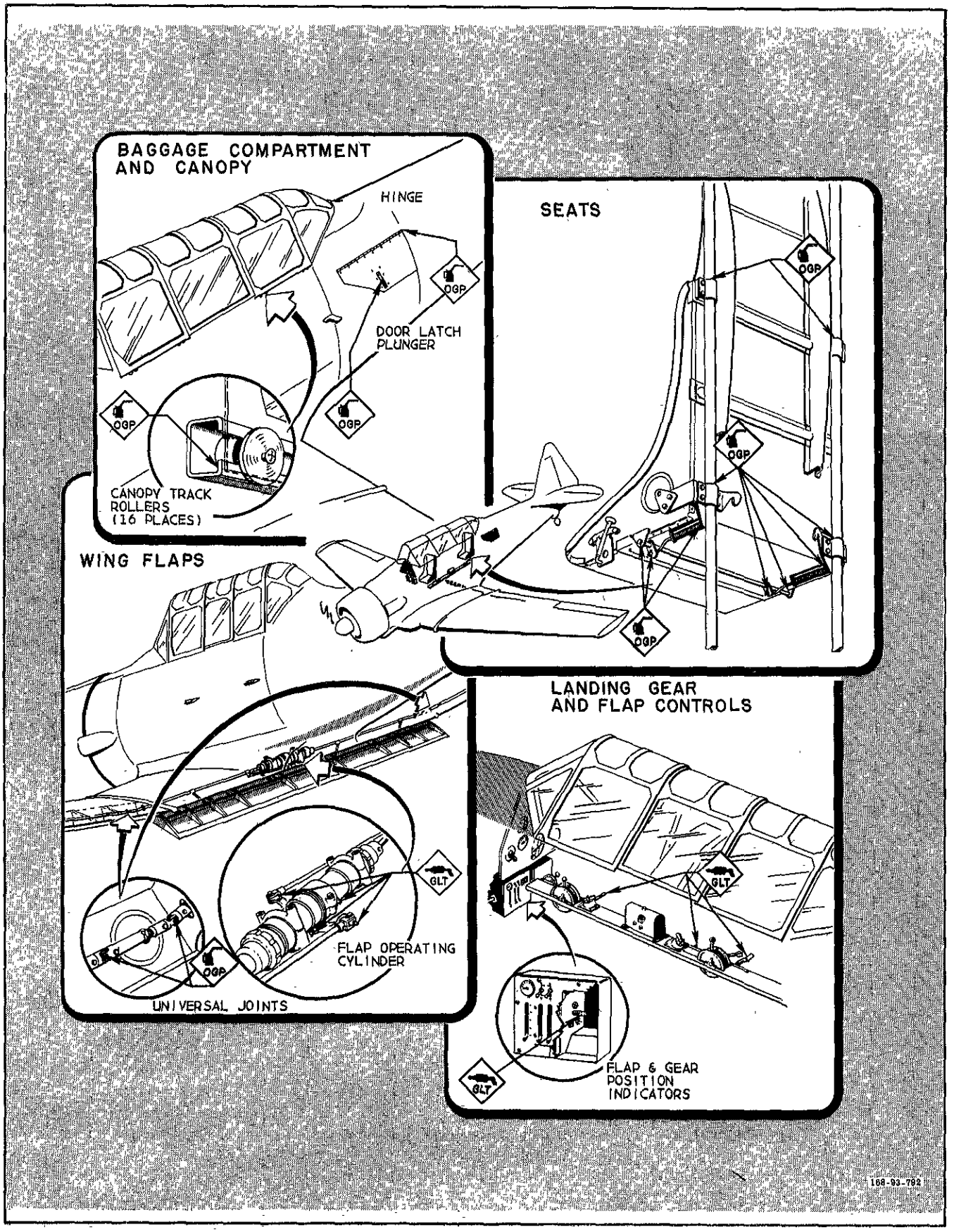


Figure 3-10 (Sheet 2 of 3 Sheets). Lubrication Chart

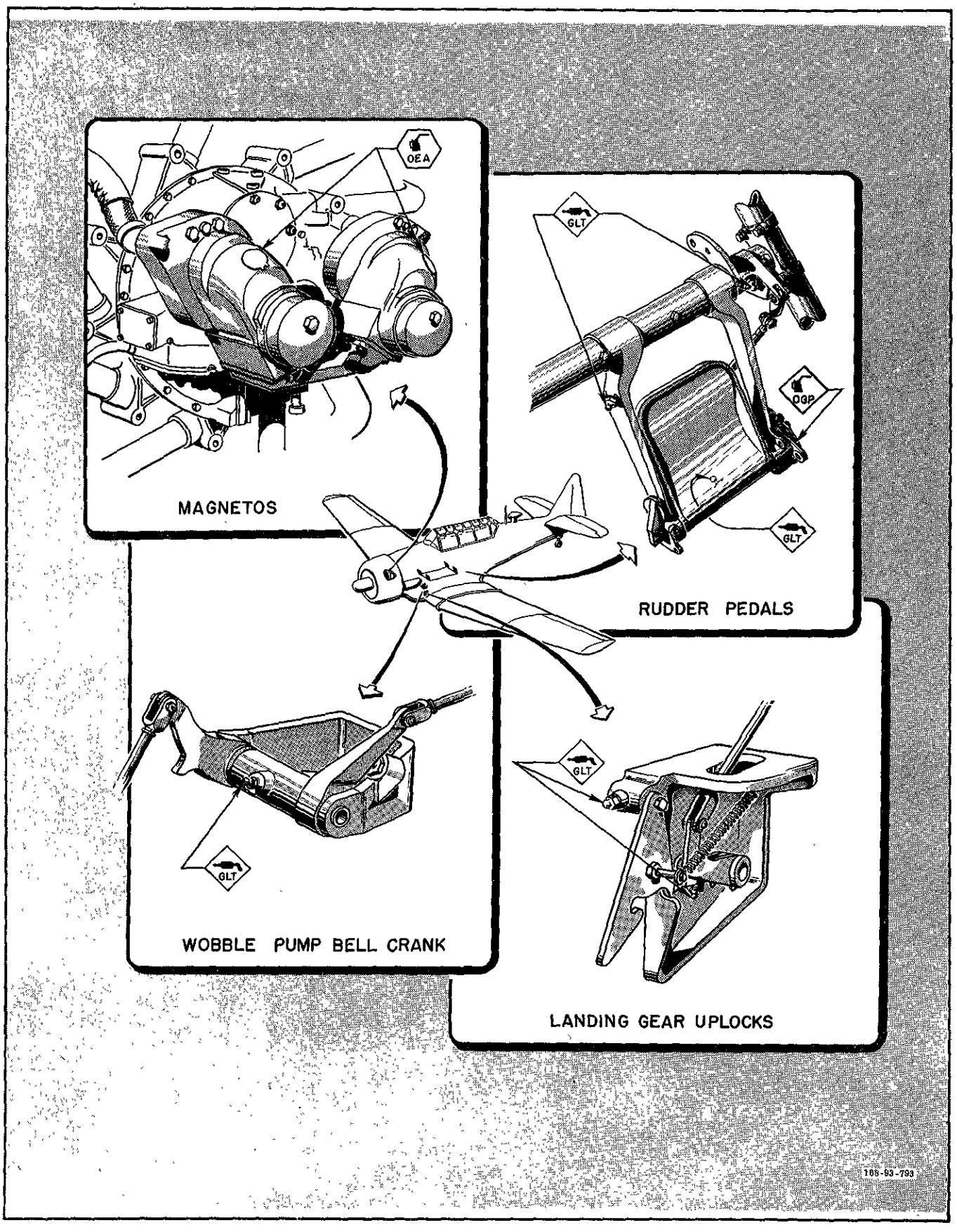


Figure 3-10 (Sheet 3 of 3 Sheets). Lubrication Chart

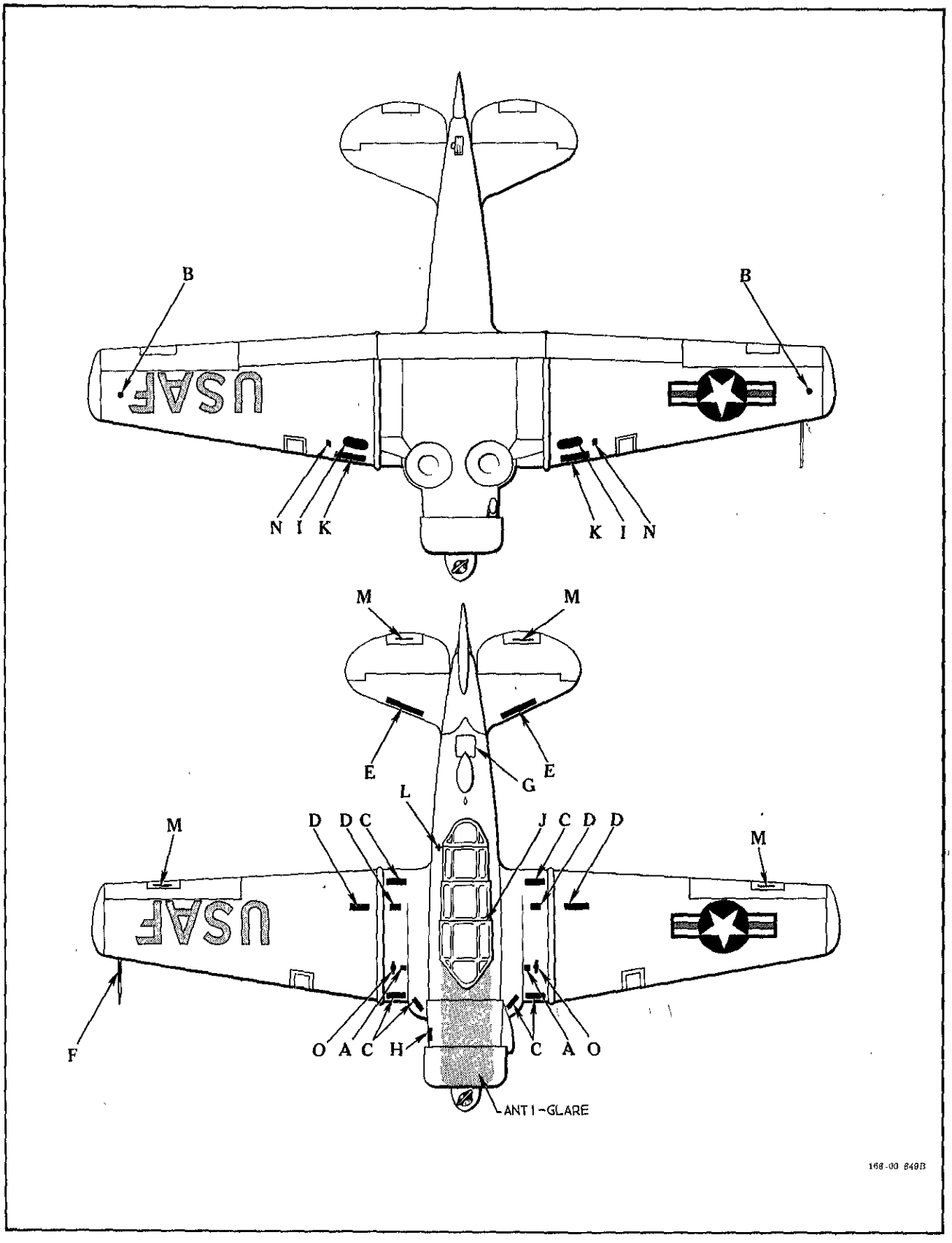


Figure 3-11 (Sheet 1 of 5 Sheets). Markings Diagram

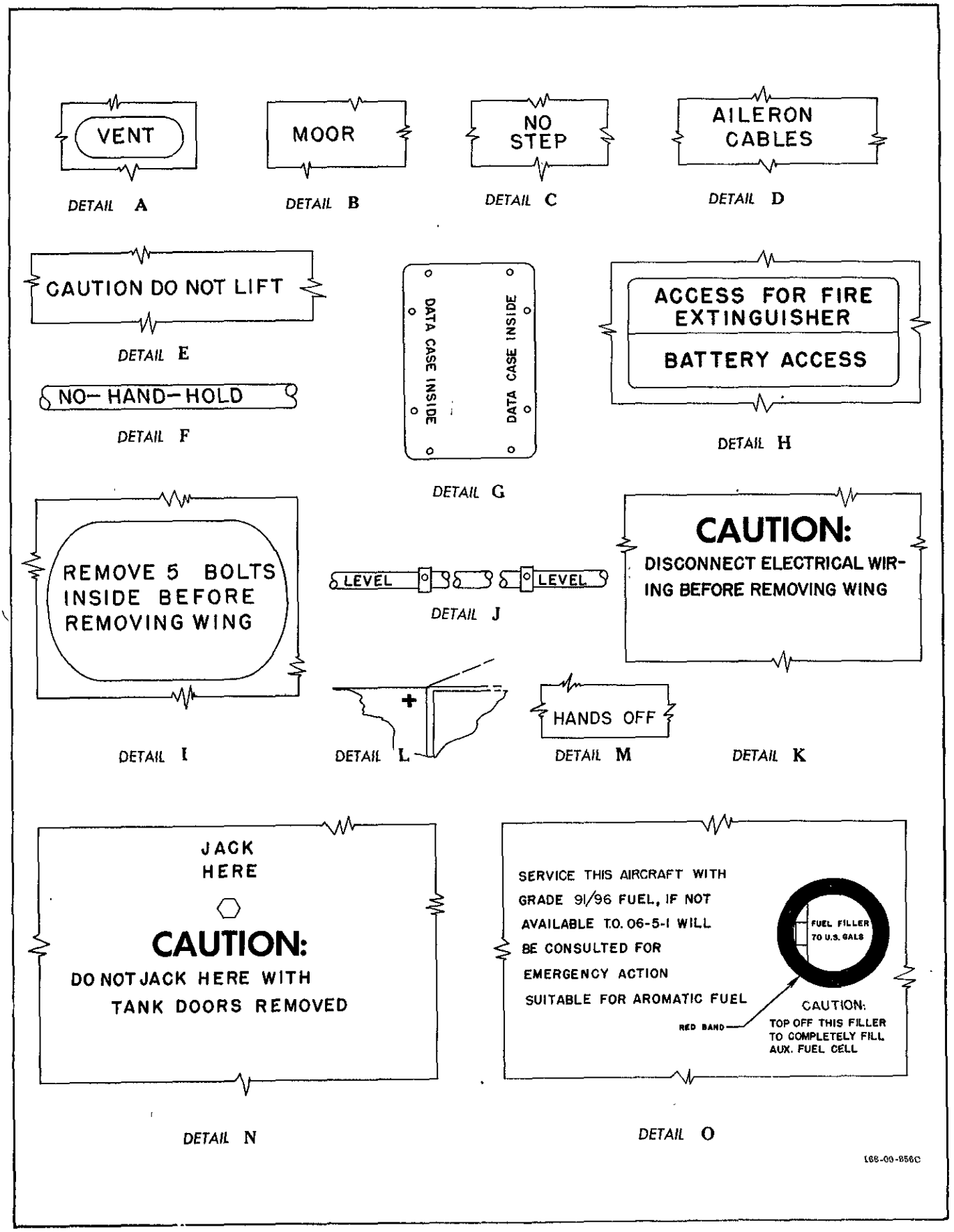
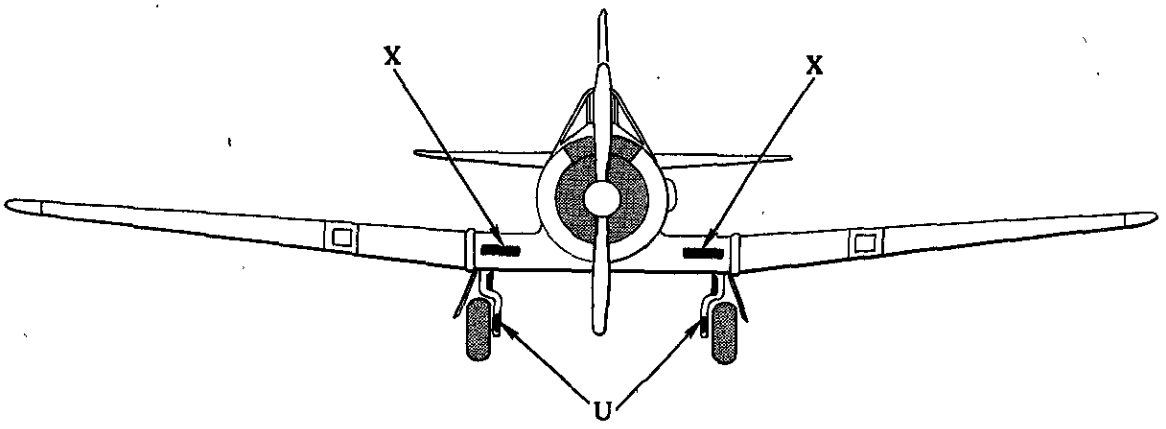


Figure 3-11 (Sheet 2 of 5 Sheets). Markings Diagram



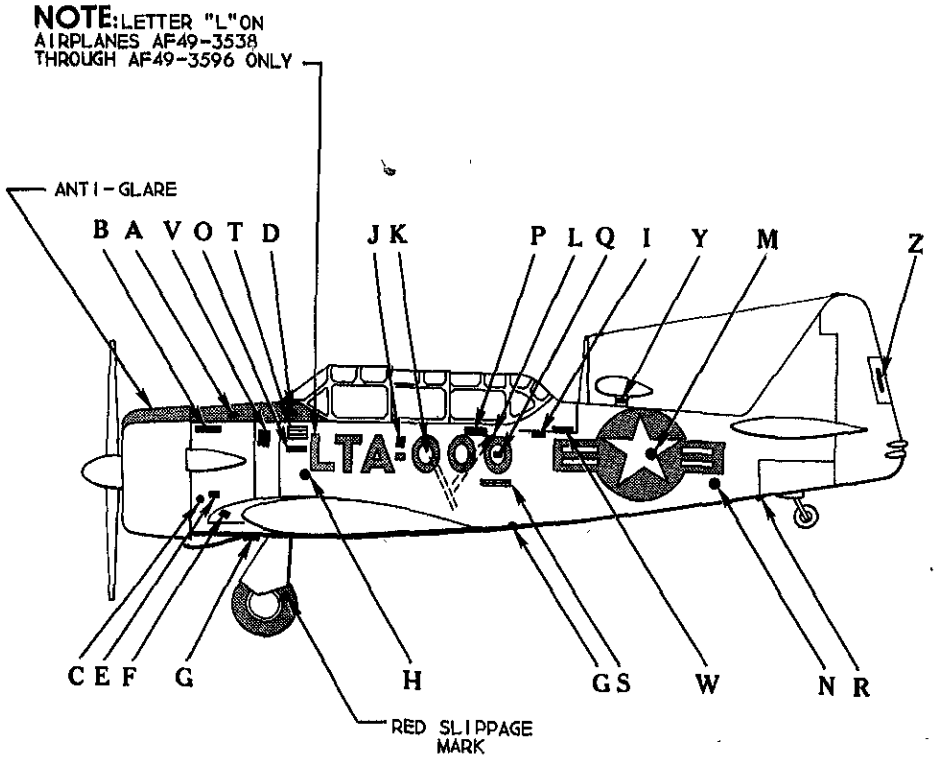


Figure 3-11 (Sheet 3 of 5 Sheets). Markings Diagram

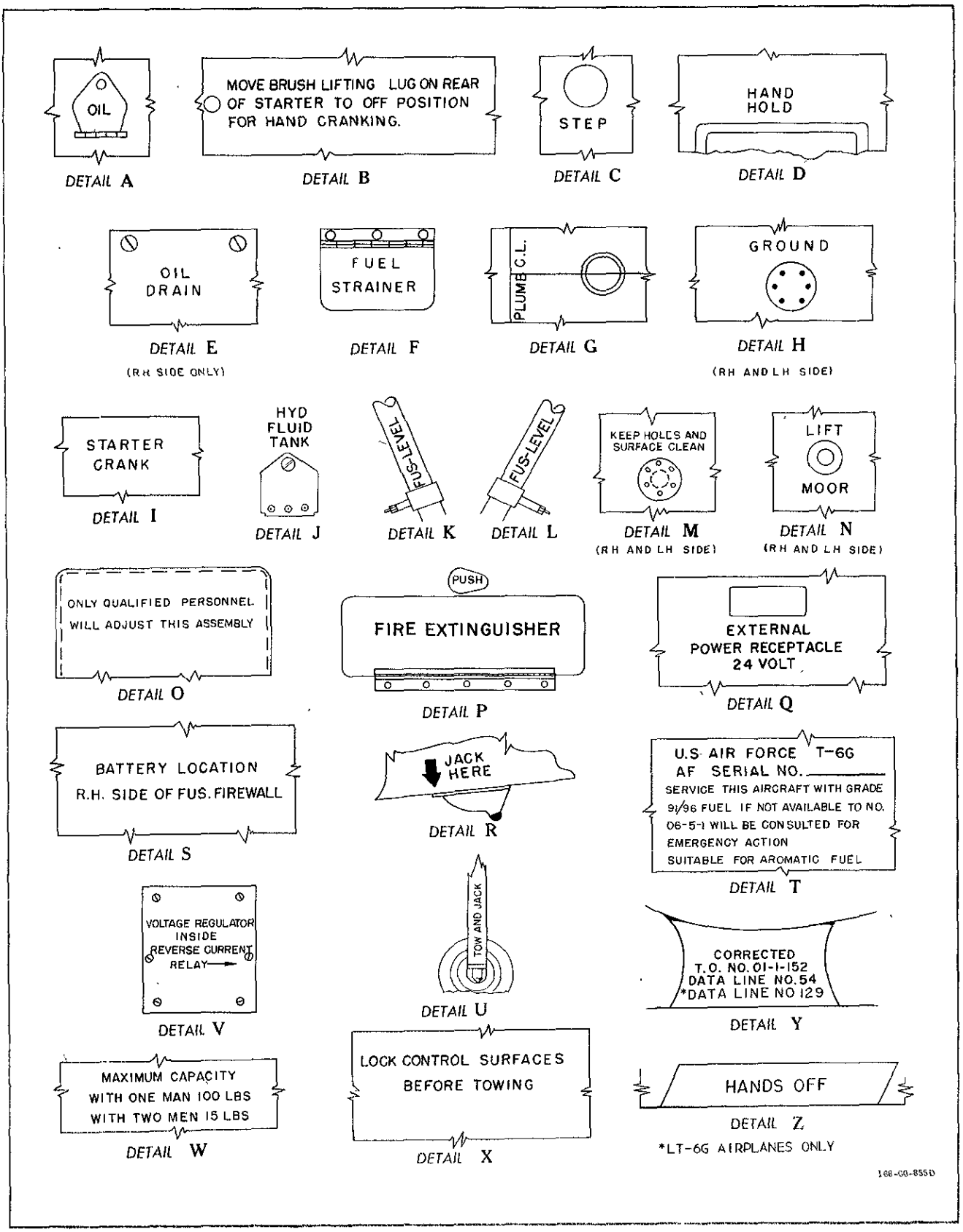


Figure 3-11 (Sheet 4 of 5 Sheets). Markings Diagram

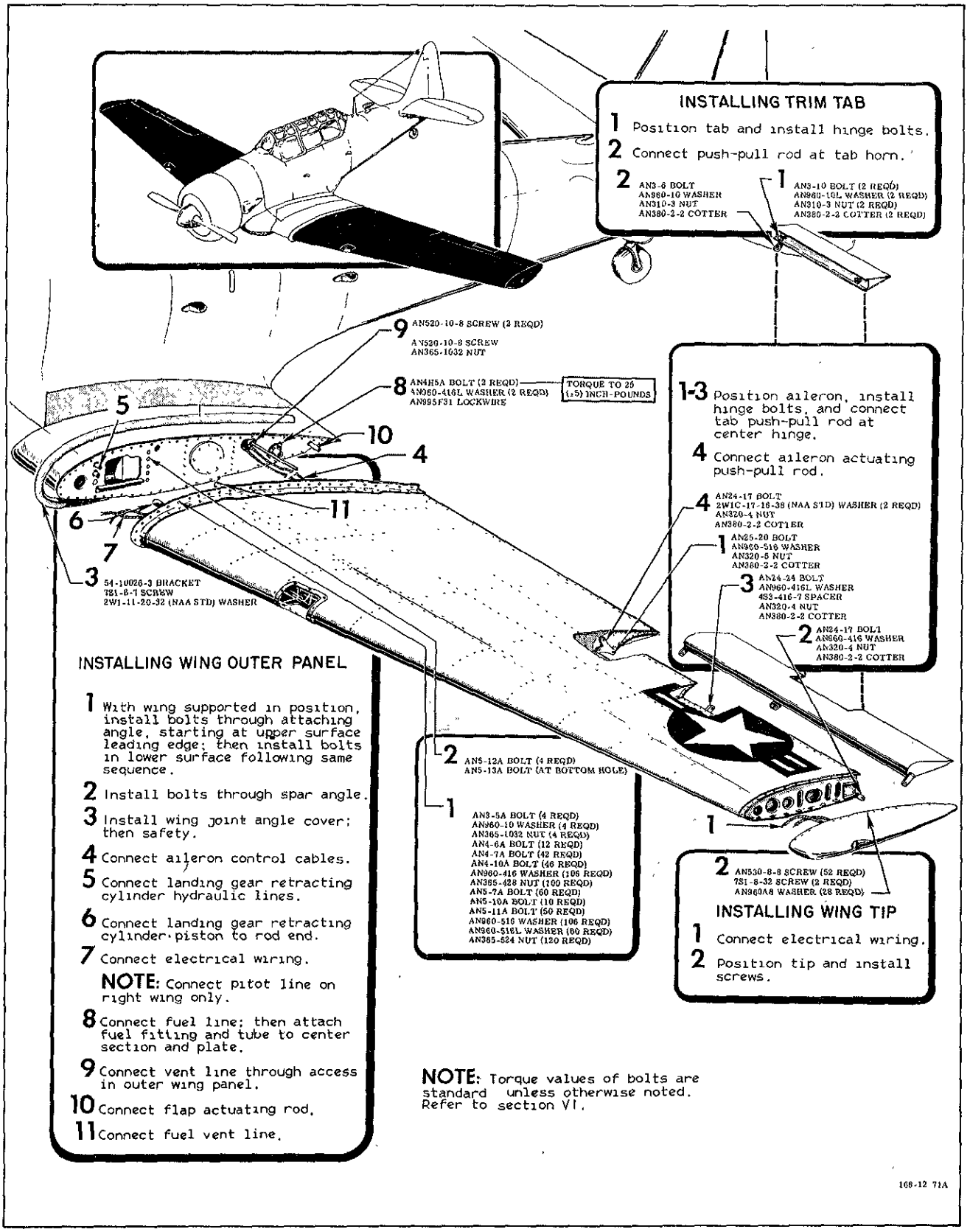


Figure 4-1. Installing Wing Outer Panel, Wing Tip, Aileron and Aileron Trim Tab

the spar angle to the center section. Access to the bolts is obtained through the inspection door on the underside of the outer panel, just outboard of the wing attaching angle forward of the spar.

m. Remove the bolts from the wing attaching angle of the lower surface first, starting at the trailing edge and working to the leading edge; then remove bolts from upper attaching angle, starting at trailing edge and working to leading edge.

CAUTION

When removing the outer panel from the center section, exercise care in guiding the landing gear hydraulic retracting cylinder piston rod and fuel lines through the center section end plate, or damage to the structure and lines may occur. Outer wing panel weighs approximately 435 pounds.

4-8. INSTALLING WING OUTER PANEL. See figure 4-1.

4-9. WING TIP.

4-10. The wing tips are of all-metal construction and are fastened to the wing by means of screws. Each tip contains a running light.

4-11. REMOVING WING TIP. The parts and components referred to in the following procedure are shown in figure 4-1. Remove the wing tip as follows: Remove inspection door on wing undersurface at tip, and disconnect electrical wiring to tip. Remove screws from around the perimeter of the tip; then remove tip.

4-12. INSTALLING WING TIP. See figure 4-1.

4-13. AILERONS AND AILERON TRIM TABS.

4-14. The Frise-type ailerons are of a metal-frame construction, covered with doped fabric. Two lead counterbalance weights are permanently installed in the leading edge. The ailerons are attached to the wing outer panel by means of three external hinges. The ailerons extend from the outboard end of the flap to the wing tip. The ailerons are controlled by cables and a push-pull rod. A ground adjustable trim tab is attached to the trailing edge of the ailerons by means of two hinges.

4-15. REMOVING AILERONS AND AILERON TRIM TABS. The parts and components referred to in the following procedure are shown in figure 4-1. Remove the ailerons and aileron trim tab as follows:

a. Disconnect the trim tab connecting rod from the aileron hinge.

b. Remove the two hinge bolts through tab hinges, and remove tab.

c. With aileron in the down position, disconnect the actuating push-pull rod at the aileron inboard end.

d. Remove hinge bolts from the three hinges, and remove aileron.

4-16. INSTALLING AILERON AND AILERON TRIM TABS. See figure 4-1.

4-17. WING FLAPS.

4-18. Three interconnected, split-type, hydraulically actuated wing flaps are incorporated in the lower surface of the wing trailing edge. (See figure 4-2.) The flap panels are of all-metal, stressed-skin construction, and extend the full distance between the ailerons. The wing center section flap panel is attached by five hinge brackets, and each outer panel flap is attached by three hinge brackets. All three flap panels are actuated simultaneously by turnbuckle rods connected to push-pull rods that are attached to the hydraulic actuating cylinder. The center section flap push-pull rods are connected at the outboard ends to the outer panel rods by universal joints. The actuating cylinder, which incorporates dual pistons interconnecting by an equalizing mechanism, is mounted under the wing center section upper surface, behind the rear spar. (Refer to paragraph 4-32.) The wing flaps are controlled by a hydraulic selector valve assembly which is mounted below the control shelf at the forward left side of the rear cockpit. The selector valve assembly is a composite unit that incorporates a power control valve, pressure relief valve, check valves, and wing flap and landing gear selector valves. (Refer to paragraphs 4-342 through 4-347 for explanation of the functioning of the incorporated valves.) The flap selector valve is positioned by the control handle of either cockpit through a bell crank arrangement, which also mechanically engages the power control valve so that hydraulic pressure will be available to be diverted to the actuating cylinder. The interconnected flap control handles are located on the control shelf at the left side of each cockpit. The flaps are hydraulically locked at the desired position by a ratchet valve mounted on the lower left fuselage longeron below the selector valve. (Refer to paragraph 4-34.) The down travel of the flaps to 45 degrees is limited by a nonadjustable stop on each piston rod of the actuating cylinder. The pistons of the actuating cylinder bottom to limit flap up travel. The slow landing speed of the airplane obviates the need for an emergency means of lowering the flaps. A flap position indicating system is incorporated. (Refer to paragraph 4-36.)

4-19. WING FLAP OPERATION.

4-20. Movement of the interconnected flap control handles engages the power control valve, and positions the flap selector valve through a push-pull rod and bell crank arrangement. Hydraulic fluid under pressure, from the airplane hydraulic system, is thus diverted by the power control valve to the flap selector valve, which directs hydraulic pressure to the actuating cylinder. (See figures 4-3 and 4-59.) Return flow from the actuating cylinder is ported through the flap selector valve to the reservoir return line. The resultant operation of the flap panels is synchronized by the equalizing mechanism incorporated

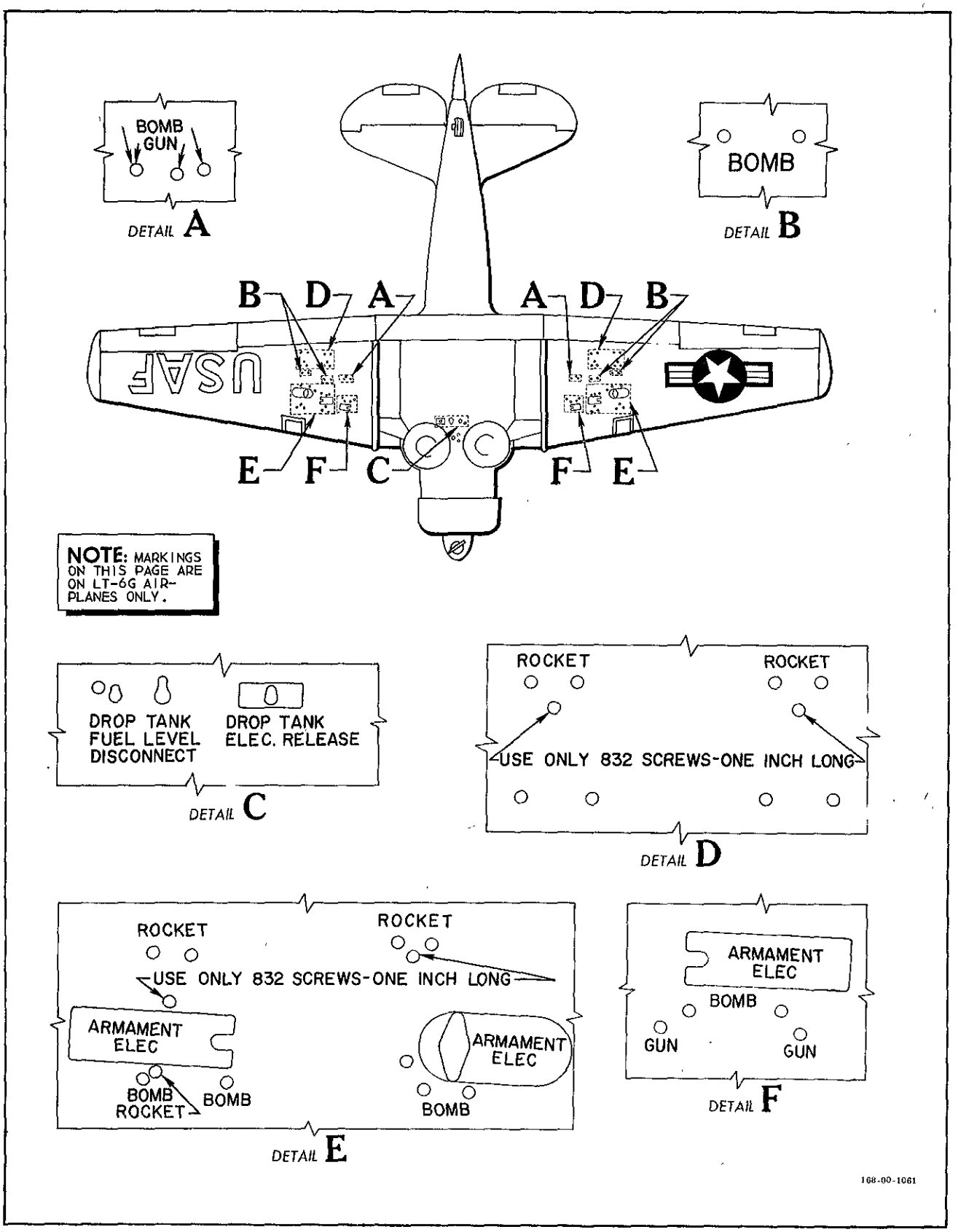


Figure 3-11. (Sheet 5 of 5 Sheets). Markings Diagram

SECTION IV

GENERAL MAINTENANCE

4-1. WING.

4-2. The wing is an all-metal, full-cantilever, semi-monocoque structure, consisting of a center section and two outer panels with removable ailerons, flaps, and tips. The outer panels are attached to the center section by means of bolts through the main spar and through chordwise external attaching angles. The center section is attached to the fuselage by means of eight tension bolts. A fairing is installed between the fuselage and the wing center section for streamlining.

4-3. WING CENTER SECTION.

4-4. The wing center section is an all-metal, two-spar structure. The lower surface between the front and rear spars forms the access doors to the two fuel tanks. A small door is provided on each fuel tank compartment door for access to the fuel tank sumps. The landing gear support fittings and locking mechanism are attached to the outboard ends of the front spar. The leading edge is detachable to facilitate removal of the landing gear. A fresh-air port and air duct are contained in the left-hand detachable leading edge. A landing gear illuminating light is located on the underside of the detachable leading edges. (Refer to paragraph 4-114.) Hydraulic lines and electrical wiring are routed through the leading edge. A split-type flap extends the entire length of the lower surface of the trailing edge. The center section is attached to the fuselage by means of eight bolts through the spar caps. (See figure 4-11.) Walkways are provided on the wing upper surface on each side of the fuselage. Provisions for hoisting shackles are installed at front spar near wing attaching angle.

4-5. WING OUTER PANEL.

4-6. The wing outer panel is of all-metal, single-spar, full cantilever construction and is attached to the center section by means of bolts through the inboard end of the spar and through the attaching angles. A pitot head is installed on the right-hand wing leading edge. A landing light is installed in the leading edge of each wing, and a passing lamp is installed in the landing light bay of the left-hand wing. A fuel cell is incorporated in each wing outer panel at the inboard end. A jacking point is incorporated near the inboard end of the spar, and a mooring ring is provided near the tip of each outer panel.

4-7. REMOVING WING OUTER PANEL. The parts and components referred to in the following procedure are shown in figure 4-1. Remove the wing outer panel as follows:

NOTE

Wing outer panel can be removed with or without aileron and flap attached.

a. Remove all inspection and access door covers in the vicinity of the attaching angle.

b. Drain fuel tanks.

c. With the flaps in the full down position, disconnect the flap actuating push-pull rod at the universal joint.

d. On the right wing only, disconnect the pitot line in the leading edge; the line is accessible through the inspection door on the underside of the leading edge at attaching angle.

e. Disconnect electrical wiring at the junction box located in the leading edge of the center section, just inboard of the wing attaching angle; then remove wires from grommet in the center section end plate, allowing wires to remain with the wing outer panel.

f. Disconnect fuel transfer line and fuel vent line, and detach from center section. Access is permitted through the inspection door on the undersurface of the center section, aft of rear spar at attaching angle.

g. Disconnect fuel tank air vent line, accessible through the inspection door on the top surface of the center section, near the fuel tank filler neck.

h. Disconnect the landing gear hydraulic operating cylinder piston by backing off locknut and unscrewing rod end from piston.

i. Disconnect the landing gear retracting cylinder hydraulic lines at the wing joint end plate.

j. Disconnect aileron control cables at turnbuckles; access is gained through an inspection door located on the lower surface of the outer panel, near the attaching angle.

k. Remove the wing joint angle cover by removing the attaching screw located outboard on the bottom surface of the cover (approximately midway between the trailing and leading edges of the wing), and by removing the safety wire and raising the latch on the upper surface of the trailing edge. This will free the cover from the lower surface trailing edge fitting.

l. With the wing outer panel supported at the inboard and outboard ends, remove the five bolts attaching

on the actuating cylinder. Hydraulic fluid flow (pressure and return), between the flap selector valve and the actuating cylinder, passes through the ratchet valve. The ratchet valve, which is actually two check valves separated by a spring-centered plunger, hydraulically locks the flaps at the desired position by maintaining a fluid lock in the actuating cylinder when the flap control is placed in the "LOCK" position. Thermal expansion of the hydraulic fluid in the actuating cylinder, sufficient to cause a pressure increase in excess of 1500 (±100) psi, is relieved by a thermal relief valve incorporated in the ratchet valve. There are no angular deflection markings on the flap control; consequently, intermediate flap positions must be selected by coordinating movement of the control handle with the flap position indicator.

4-21. CHECKING WING FLAP OPERATION. Using the hydraulic hand-pump, which is provided for ground use only, verify proper functioning of the wing flap system in the following manner:

a. Operate flaps through complete cycle several times to check for smooth operation.

b. Check for synchronous operation of flap panels to verify proper adjustment of push-pull and turnbuckle rods.

c. With a protractor, check to see that flaps lower to approximately 45 degrees.

d. During flap operation, observe position indicator in each cockpit to see that indicators correspond to actual position of flaps.

e. With hydraulic pressure available from engine-driven pump, verify time required for lowering flaps to be 5 to 15 seconds, and for raising flaps to be 5 to 10 seconds.

f. Using system hydraulic pressure, lower flaps to an intermediate position and place control handle at "LOCK." Manually apply a moderate load (in each direction) to flap trailing edge to verify proper functioning of ratchet valve.

4-22. TROUBLE SHOOTING WING FLAPS.

TROUBLE	PROBABLE CAUSE	REMEDY
Flaps not synchronized, or full travel unobtainable.	Turnbuckle rods or push-pull rods improperly adjusted.	Adjust linkage.
Flaps "creep."	Internal leakage of ratchet valve.	Replace ratchet valve.
Flaps inoperative (hydraulic pressure available).	Flaps selector valve improperly adjusted.	Adjust flap selector valve plunger rod.
Flap operation slow.	Internal leakage of ratchet valve or actuating cylinder.	Replace faulty unit.
Flap indicated position does not correspond to actual position.	Position indicating mechanism improperly adjusted.	Adjust cable turnbuckles.

4-23. ADJUSTING WING FLAPS.

4-24. See figure 4-2.

4-25. REMOVING WING FLAPS.

4-26. The parts and components referred to in the following procedure are identified in figure 4-2. Remove individual wing flap panels as follows:

NOTE

Original setting of wing flap system may be left undisturbed by retaining the adjustment of the turnbuckle rods and push-pull rods.

a. Hydraulically position the flaps to full down.

b. Disconnect the spring-loaded flap position indicating cable from the center flap panel.

c. Disconnect the turnbuckle rods from the individual flap panel to be removed.

d. Remove the hinge point bolts from the center section or outer panel flaps, and remove the respective flap panels.

4-27. INSTALLING WING FLAPS.

4-28. See figure 4-2.

4-29. WING FLAP SELECTOR VALVE.

4-30. The wing flap selector valve is contained within the composite selector valve unit with the landing gear selector valve, and both flap and gear selector valves function in an identical manner. The selector valve unit is mounted at the forward left side of the rear cockpit, below the control shelf.

4-31. WING FLAP ACTUATING CYLINDER.

4-32. The flap actuating cylinder, mounted behind

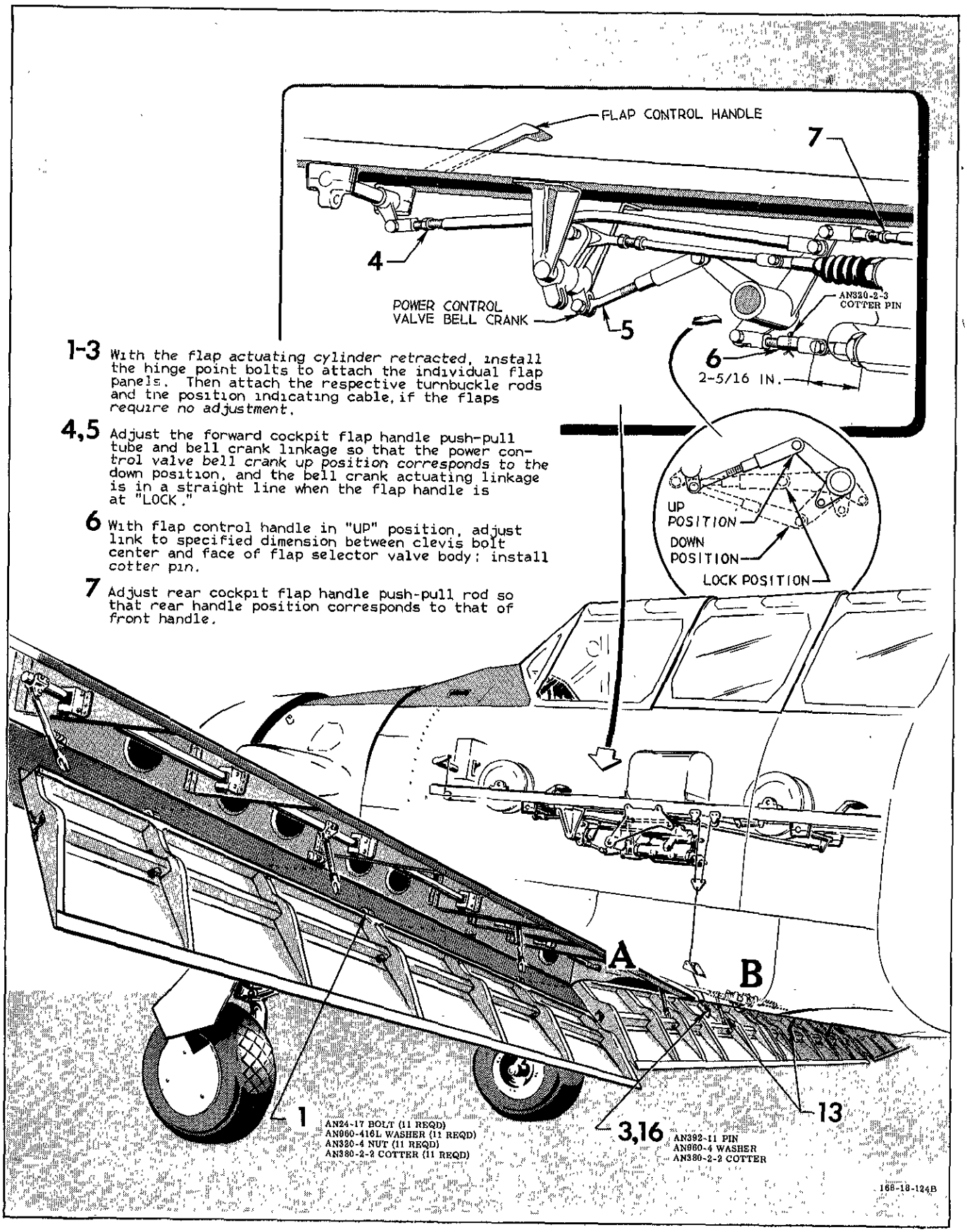


Figure 4-2 (Sheet 1 of 2 Sheets). Installing and Adjusting Wing Flaps

8-10 With turnbuckle rods and both universal links disconnected, fully retract flap actuating cylinder by means of hydraulic hand-pump while adjusting equalizing rods to fit.

11 Adjust and attach the two outboard turnbuckle rods of the center flap panel to position flap at approximately 45 degrees down, as shown.

12 Cautiously extend actuating cylinder, using hand-pump hydraulic pressure, and observe center flap during raising for absence of twisting.

NOTE: To eliminate twisting, it will be necessary to adjust push-pull rod connection at right piston rod end of actuating cylinder; then compensate length of turnbuckle rod and equalizing rods. When the flap is completely raised (streamlined), there must be a very slight clearance between the wing trailing edge and flap panel.

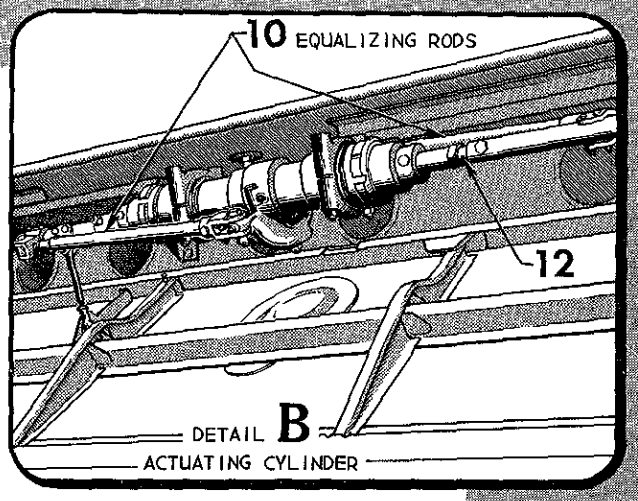
13 Lower flaps; then adjust and attach the two remaining turnbuckle rods of the center flap panel.

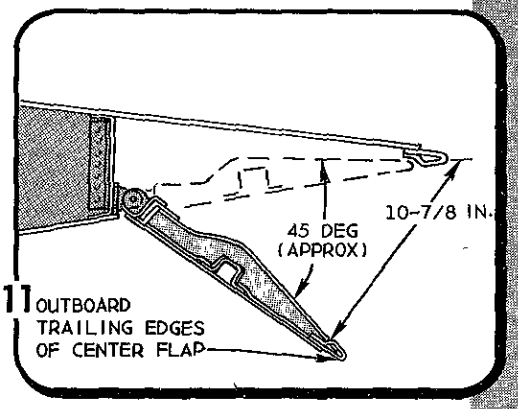
14 Adjust the universal links so that approximately seven threads are exposed; then adjust and attach turnbuckle rods of outer panel flaps to position flaps at approximately 45 degrees down.

15 Cautiously extend actuating cylinder, using hand-pump hydraulic pressure, and observe flap panels for synchronous operation.

NOTE: All flap panels must reach full up (streamlined) position simultaneously (with a very slight gap). If they do not, adjust the applicable universal link and compensate the respective panel turnbuckle rods so that the outboard flaps are positioned to correspond with the center flap. Tighten all turnbuckle rod clevis jam nuts after adjustments are completed.

16 Attach cable and adjust turnbuckles so that flap indicated position corresponds to actual position.





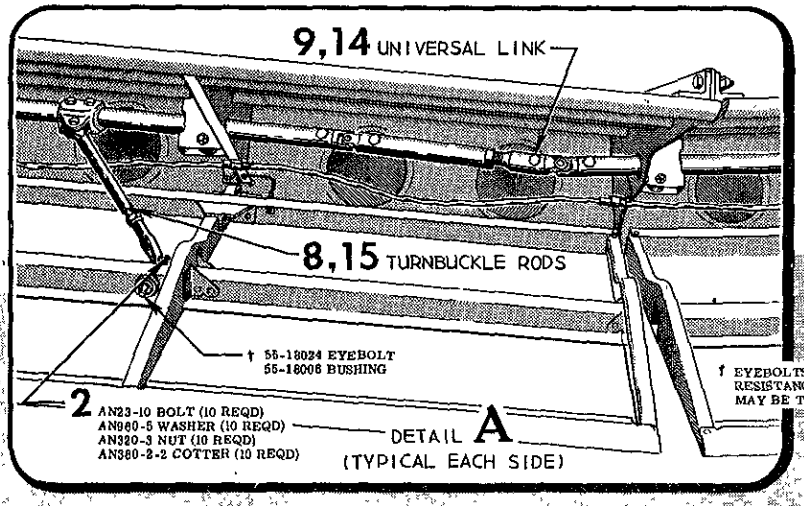


Figure 4-2 (Sheet 2 of 2 Sheets). Installing and Adjusting Wing Flaps

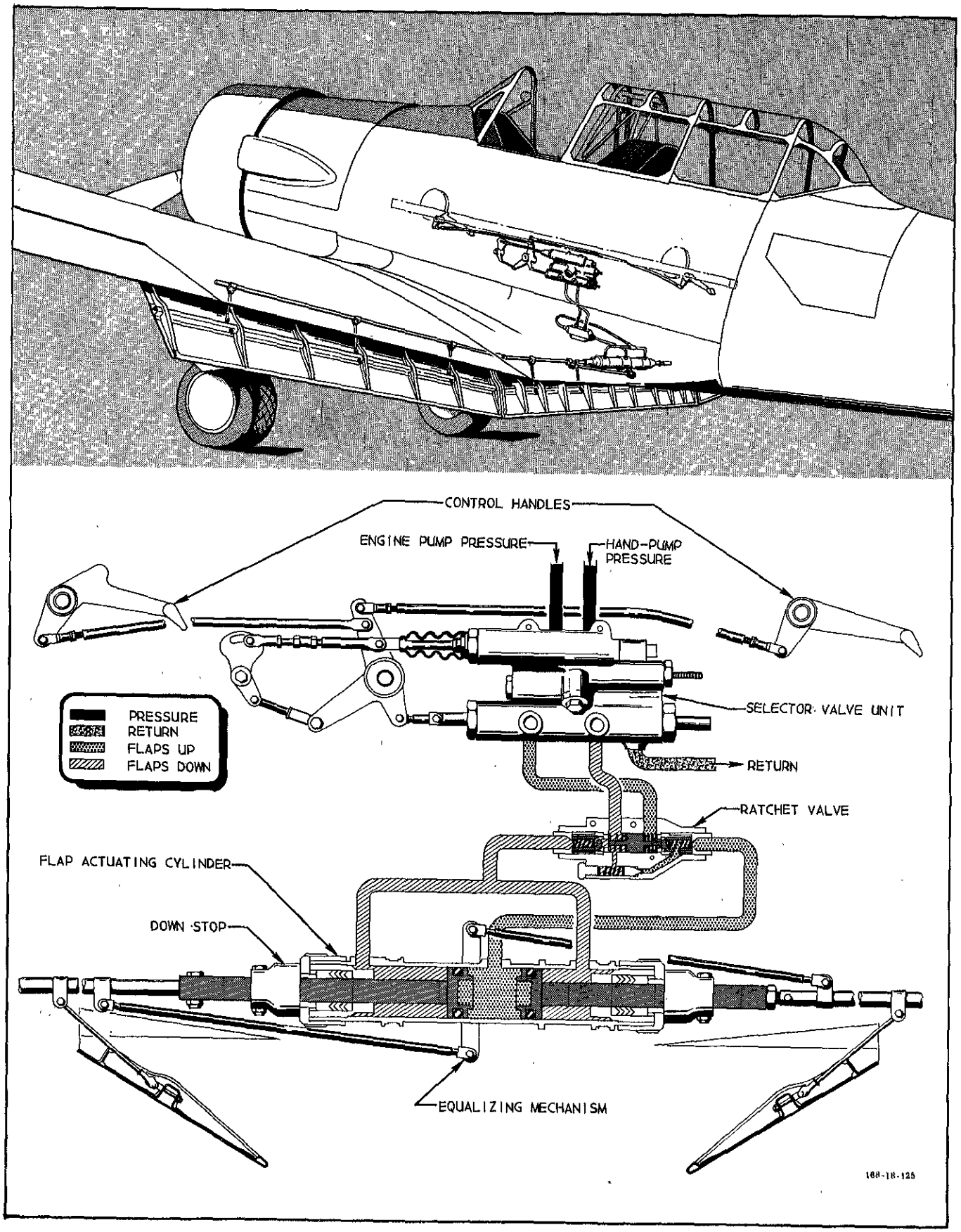


Figure 4-3. Wing Flap System Schematic Diagram

the wing center section rear spar, incorporates dual pistons interconnected by an equalizing mechanism. The equalizing mechanism consists of a pivoted cross arm and two equalizer rods. The equalizer rods connect the crossarm to each piston rod end so that the pistons actuate in unison. Fluid pressure applied to the port at each end of the actuating cylinder causes the pistons and push-pull rods to be simultaneously moved toward the center of the cylinder, thus extending the flaps.

4-33. WING FLAP RATCHET VALVE.

4-34. The flap ratchet valve consists of a spring-centered plunger between two opposing check valves. The valve function is to hydraulically lock the flaps in any desired position. The ratchet valve, mounted on the lower left fuselage longeron, incorporates an adjustable thermal relief valve to relieve pressure increases, in excess of 1500 (±100) psi, resulting from thermal expansion.

4-35. WING FLAP POSITION INDICATING SYSTEM.

4-36. The positions of the wing flaps are mechanically transmitted by cables to a finger-type indicator in each cockpit. The front cockpit indicator is located below the instrument panel on the left side, and the indicator in the rear cockpit is on the left control shelf. The actuating cable is attached to the center section flap.

4-37. ADJUSTING WING FLAP POSITION INDICATING SYSTEM. See figure 4-2.

4-38. EMPENNAGE.

4-39. The empennage consists of a vertical and horizontal stabilizer, two elevator panels, and a rudder. The stabilizers are full-cantilever, stressed-skin structures. Each control surface is constructed of a metal frame and doped fabric covering. Mechanically actuated trim tabs are incorporated at the trailing edge of each elevator panel and at the trailing edge of the rudder.

4-40. VERTICAL STABILIZER.

4-41. The vertical stabilizer is an all-metal, full-cantilever structure that incorporates a single spar at the aft edge, and a shear web at the leading edge. The vertical stabilizer is attached to the fuselage by means of three bolts, two through the lower end of the spar, and one through the attaching fitting at the lower end of the shear web. The vertical stabilizer is faired and streamlined with the fuselage by removable fairings.

4-42. REMOVING VERTICAL STABILIZER. The parts and components referred to in the following procedure are shown in figure 4-4. Remove the vertical stabilizer as follows:

a. Remove fairings from around base of vertical stabilizer.

b. Remove rudder. (Refer to paragraph 4-46.)

c. Remove two bolts from lower end of spar attaching fitting.

d. Remove bolt from front shear web attaching fitting, and raise vertical stabilizer to remove.

4-43. INSTALLING VERTICAL STABILIZER. See figure 4-4.

4-44. RUDDER AND RUDDER TRIM TAB.

4-45. The rudder is constructed of an all-metal frame covered with doped fabric, and incorporates a static balance weight at the top in the leading edge. Breather and drain holes are incorporated in the fabric covering at the trailing edge. The rudder also incorporates a pilot-controlled, mechanically actuated, all-metal trim tab at the trailing edge. Access to the trim tab control mechanism is obtained through an inspection door on the right-hand side of the rudder near the center hinge. Two navigation lamps are installed on the trailing edge at the bottom of the rudder. The rudder is attached to the spar of the vertical stabilizer by means of three sealed ball-bearing hinge brackets, and is actuated by control cables attached to the rudder horn.

4-46. REMOVING RUDDER. The parts and components referred to in the following procedure are shown in figure 4-4. Remove rudder as follows:

a. Remove access doors from leading edge of rudder at center and lower hinges.

b. Disconnect trim tab control cable turnbuckles in fuselage rear section, and pull cables through vertical stabilizer spar.

c. Disconnect rudder control cables at rudder horn.

d. Disconnect antenna from top of rudder at the hinge point centerline.

e. Disconnect electrical wiring at forward side of vertical stabilizer spar in tail wheel well.

f. Remove bolt from the lower hinge fitting; then remove nut from the center and top hinge brackets.

4-47. REMOVING RUDDER TRIM TAB. The parts and components referred to in the following procedure are shown in figure 4-4. Remove the rudder trim tab as follows:

a. Disconnect trim tab actuator push-pull rod at tab horn.

b. Deflect trim tab to extreme left; then remove the two hinge bolts, and remove tab.

4-48. INSTALLING RUDDER AND RUDDER TRIM TAB. See figure 4-4.

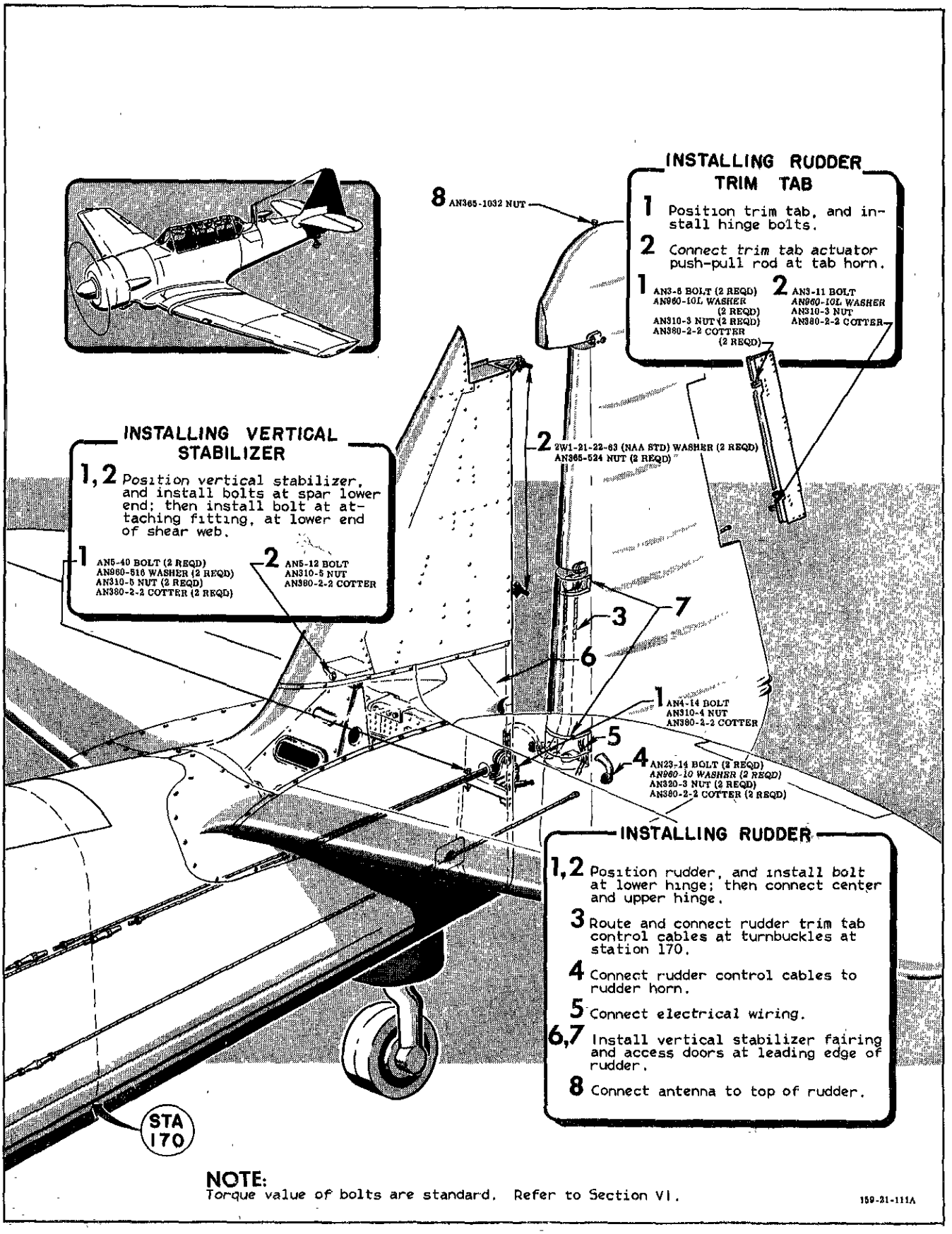


Figure 4-4. Installing Vertical Stabilizer, Rudder and Rudder Trim Tab

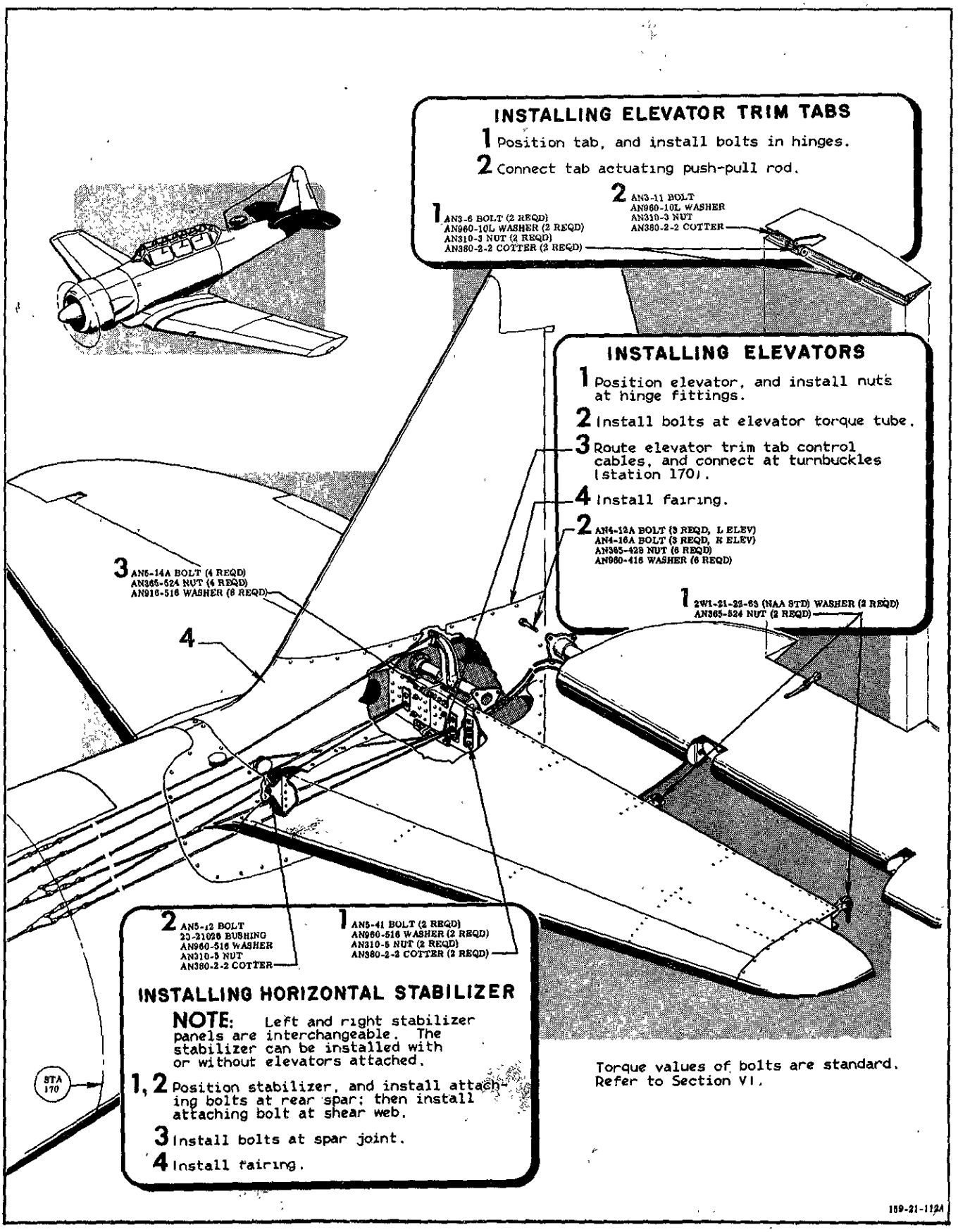


Figure 4-5. Installing Horizontal Stabilizer, Elevator and Trim Tabs

4-49. HORIZONTAL STABILIZER.

4-50. The horizontal stabilizer is an all-metal, stressed-skin, full-cantilever structure that incorporates a spar at the aft edge, and a shear web at the leading edge. The horizontal stabilizer, consisting of two identical halves joined by four bolts through the inboard ends of the spar, is attached to the fuselage by a bolt through the shear web inboard end (on each horizontal stabilizer half), and four bolts through the spar lower edge.

4-51. REMOVING HORIZONTAL STABILIZER. The parts and components referred to in the following procedure are shown in figure 4-5. Remove the horizontal stabilizer as follows:

NOTE

Horizontal stabilizer halves can be removed independently or as a unit (with or without elevator panels attached).

a. Remove all fairings from horizontal stabilizer.

b. Disconnect elevator control cables from the elevator control horn if horizontal stabilizer halves are being removed as a unit.

c. Disconnect elevator trim tab control cables at turnbuckles in fuselage rear section, and pull cables through horizontal stabilizer spar.

d. Remove vertical stabilizer if horizontal stabilizer halves are being removed as a unit. (Refer to paragraph 4-42.)

e. Remove both bolts from respective sides of the spar joint attaching the lower edge of the horizontal stabilizer spar to the fuselage.

f. If one half of the horizontal stabilizer is being removed, remove lateral bolts at spar joint, and detach elevator at inboard end of torque tube.

g. From respective half of the horizontal stabilizer, remove bolt attaching the shear web to fuselage; then remove stabilizer.

4-52. INSTALLING HORIZONTAL STABILIZER. See figure 4-5.

4-53. ELEVATOR AND ELEVATOR TRIM TAB.

4-54. The elevator panels, which incorporate a permanently attached balanced weight in the leading edge, consist of two identical all-metal frames covered with doped fabric. Breather holes are incorporated in the undersurface at the trailing edge. The two elevator halves are joined by means of a torque tube. The elevator panels extend the entire span of the horizontal stabilizer, and each is attached to the stabilizer spar by three permanently sealed ball bearing hinge fittings. The elevators are controlled by means of cables attached to a horn located between the elevator panels. A pilot-controlled, mechanically actuated, all-metal trim tab is installed at the trailing edge of each elevator panel. Each trim tab is attached to the elevator by means of two hinges.

4-55. REMOVING ELEVATOR. The parts and components referred to in the following procedure are shown in figure 4-5. Elevator panels can be removed independently or as a unit. Remove as follows:

a. Remove fairing from inboard end of each elevator panel.

b. Disconnect elevator trim tab control cables at turnbuckles in fuselage rear section, and pull cables through horizontal stabilizer spar.

c. To remove only one elevator panel, disconnect the torque tube at the elevator control horn. If both elevator panels are being removed as a unit, disconnect the elevator control cables from the elevator control horn.

d. Disconnect the elevator assembly from the hinge brackets on the spar of the horizontal stabilizer, and remove respective elevator panel. Both panels may now be removed as a unit if the vertical stabilizer has been previously removed. (Refer to paragraph 4-42 for instructions concerning removal of vertical stabilizer.)

4-56. REMOVING ELEVATOR TRIM TABS. The parts and components referred to in the following procedure are shown in figure 4-5. Remove the trim tab as follows:

a. Disconnect trim tab actuator push-pull rod at tab horn.

b. Deflect tab and remove two hinge bolts; then remove tab.

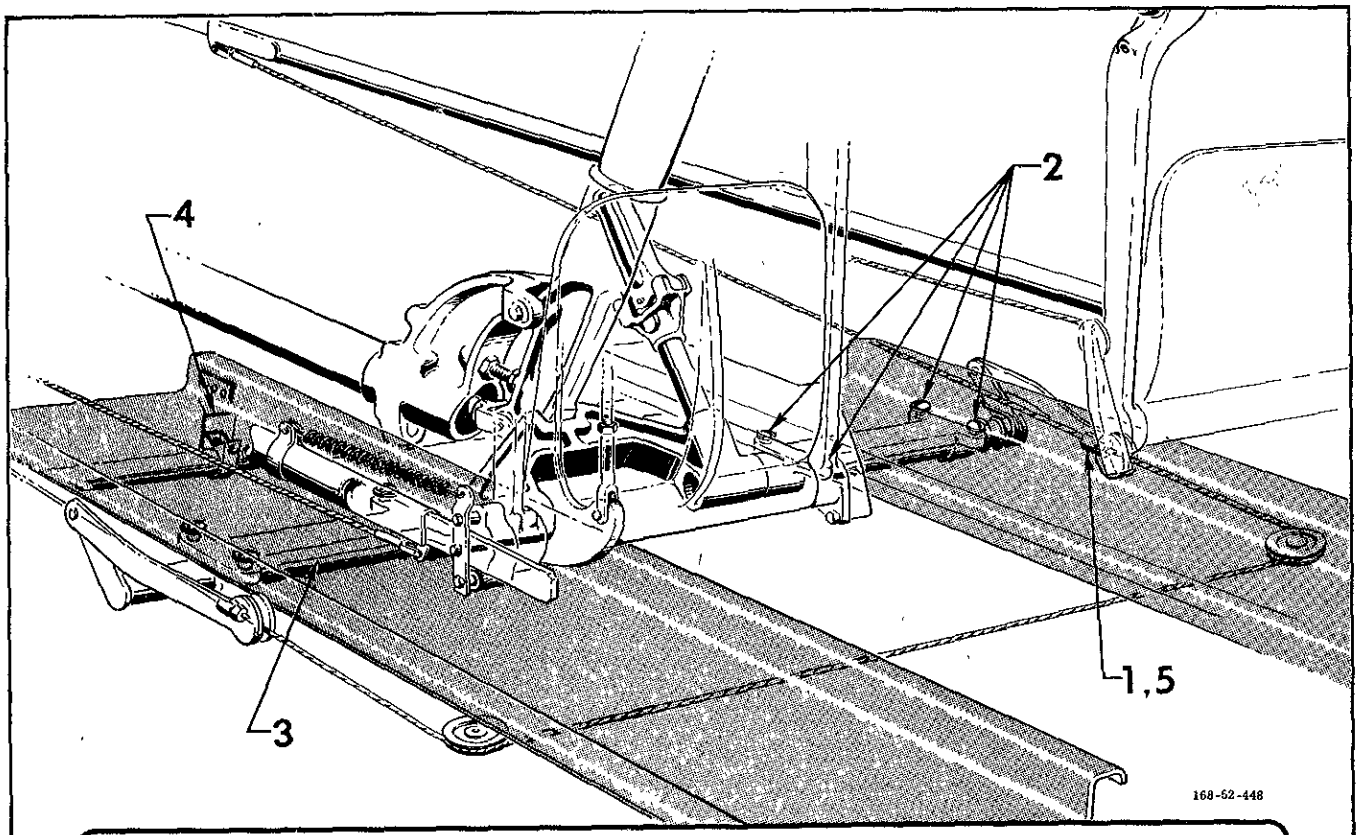
4-57. INSTALLING ELEVATOR AND ELEVATOR TRIM TABS. See figure 4-5.

4-58. SURFACE CONTROLS.

4-59. The surface control systems, including the front and rear cockpit control sticks and rudder pedals, are essentially of conventional design and are actuated through cables and bell cranks. All primary control cables are 1/8 inch in diameter with the exception of the rudder balance cable, which is 3/32 inch in diameter. The elevator and rudder trim tab cables are 1/16-inch diameter cables. To accomplish longitudinal and directional trim, manually controlled and actuated trim tabs are provided on the elevators and rudder. Lateral trim is accomplished by a ground-adjustable trim tab on each aileron. A means of locking the controls is provided in the front cockpit.

4-60. TROUBLE SHOOTING SURFACE CONTROL SYSTEMS.

TROUBLE	PROBABLE CAUSE	REMEDY
Binding or rubbing control cables.	Bent or misaligned pulley bracket.	Straighten or replace pulley bracket.
	Insufficient lubrication.	Lubricate.
	Cable off pulley.	Check alignment of pulley; check cable guards. Replace pulley if worn.
	Cables incorrectly routed.	Correct cable routing.
	Defective or dry ball bearing.	Replace pulley.
Obstructed full travel.	Control surface or control stick stops incorrectly set.	Adjust stops.



1 Loosen rudder cable stops.

2 With lock mechanism mounting screws loose and control stick in the full forward position, engage lock mechanism with control stick (locked position).

3 Position floor brackets longitudinally so that lock mechanism will engage and release freely; then tighten mounting screws.

4 If control stick is not centered in the forward position, loosen floor attachment at rear, and position floor (to which lock mechanism is attached) so that stick is centered. Tighten floor attaching bolts.

5 With lock mechanism engaged and rudder pedals centered, adjust rudder cable stops to contact mechanism. Release lock mechanism and move rudder cable stops 1/16 inch forward; then secure cable stops.

Figure 4-6. Adjusting Surface Control Lock Mechanism

TROUBLE	PROBABLE CAUSE	REMEDY
Control surface "flutter."	Interference from foreign objects.	Inspect system and clearance between fixed and movable surfaces.
	Incorrect cable tension.	Adjust cable tension.
	Excessive play at surface hinge points.	Check surface "free play"; inspect hinge points.
	Damaged control surface.	Repair or replace.
Trim tab "flutter."	Worn hinges.	Repair.
	Actuator mounting loose.	Secure mounting.
	Airfoil irregularities forward of tab.	Repair.

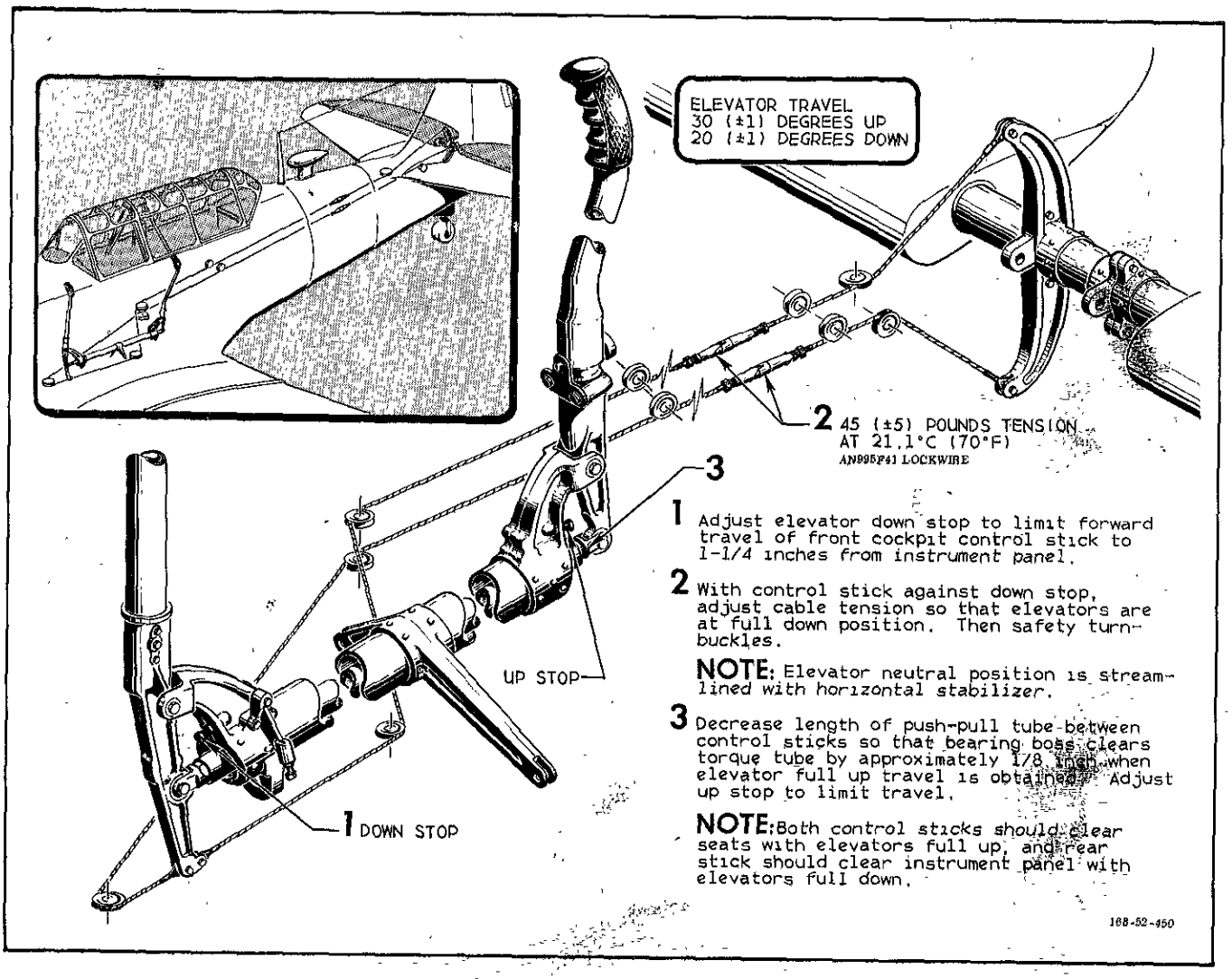


Figure 4-7. Adjusting Elevator Control System

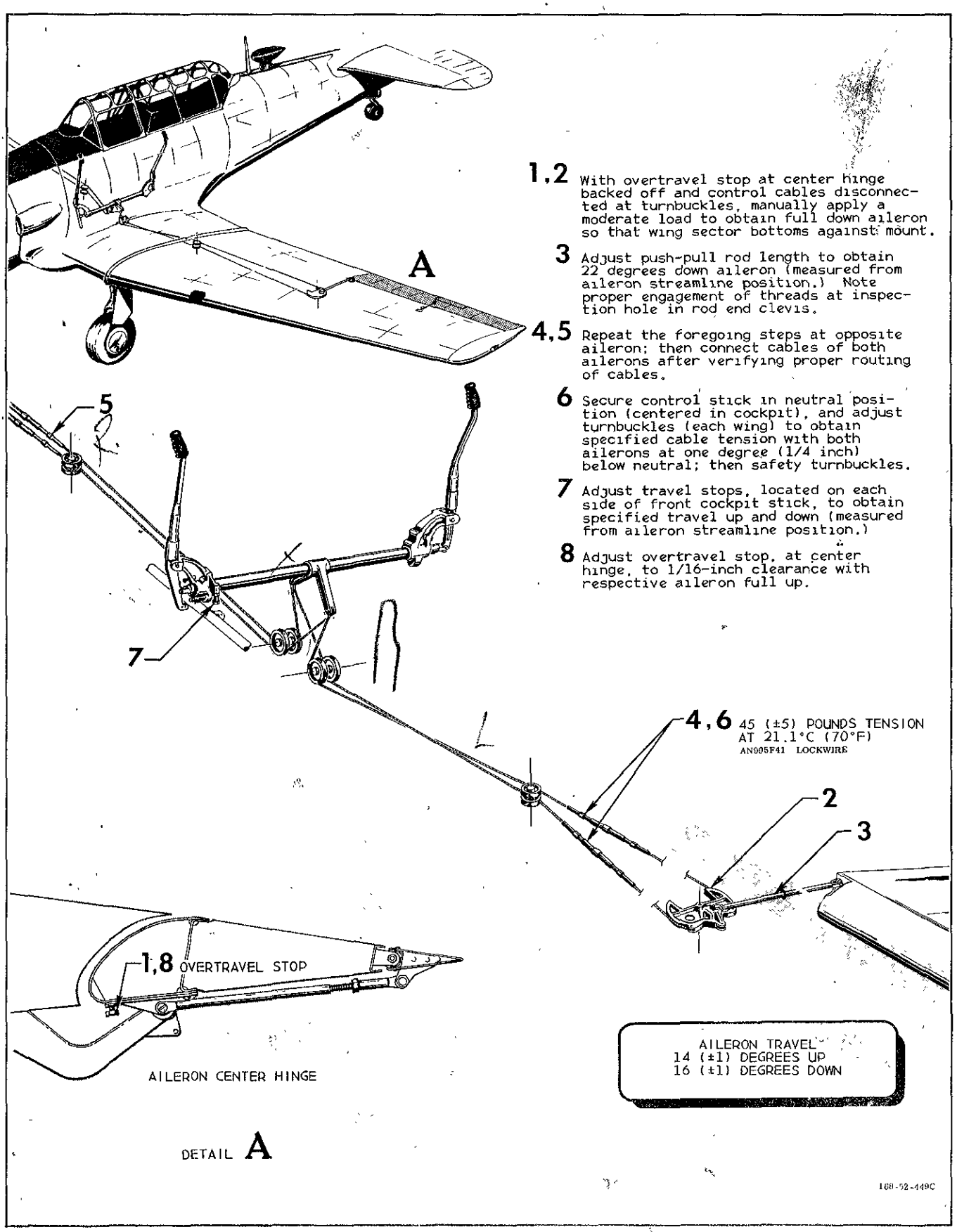


Figure 4-8. Adjusting Aileron Control System

4-61. SURFACE CONTROL LOCK MECHANISM.

4-62. To prevent damage to the control surfaces and cable systems, a locking mechanism that locks the ailerons and rudder in neutral, and the elevators in the full down position, is provided in the front cockpit. Raising the lock handle, normally stowed at the floor of the front cockpit, permits the mechanism to be directly engaged with the control stick, locking the aileron and elevator controls. Raising the lock handle also mechanically positions the rudder in neutral and locks the rudder cables.

4-63. ADJUSTING SURFACE CONTROL LOCK MECHANISM. See figure 4-6.

4-64. AILERON CONTROL SYSTEM.

4-65. The ailerons are controlled through a torque tube that interconnects both sticks. Pilot effort is transmitted to the ailerons through cables, sectors, and push-pull tubes. Stops are provided at the forward end of the torque tube, between the control sticks, to limit aileron deflection. An overtravel stop is incorporated on the center hinge bracket of each aileron.

4-66. ADJUSTING AILERON CONTROL SYSTEM. See figure 4-8.

4-67. ELEVATOR CONTROL SYSTEM.

4-68. The elevators are controlled from either cockpit by the control sticks which are interconnected by a push-pull tube that passes through the aileron control torque tube. Effort applied to the control stick is transmitted through cables to a horn that is attached to the elevator torque tube. When the control stick is positioned full forward, the horn between the elevators actuates the tail wheel declutching mechanism. (Refer to paragraph 4-118.) To limit elevator travel, stops are provided on the front and rear cockpit control stick supports.

4-69. ADJUSTING ELEVATOR CONTROL SYSTEM. See figure 4-7.

4-70. RUDDER CONTROL SYSTEM.

4-71. The rudder pedals of both cockpits are interconnected by push-pull tubes. The rudder pedal positions can be adjusted by the pilot for leg length. The pedal position adjustment mechanism locates each pedal individually. Pilot effort is transmitted to the rudder by cables that are connected to the rudder pedals in the front cockpit and a horn on the rudder. A balance cable connects both sets of rudder pedals at the push-pull tubes. The balance cable incorporates cable stops which engage with the locking mechanism to secure the rudder in neutral. Stops are provided at the rudder horn to limit the degree of rudder travel. Idler arms, in the fuselage rear section, are incorporated in the rudder system to

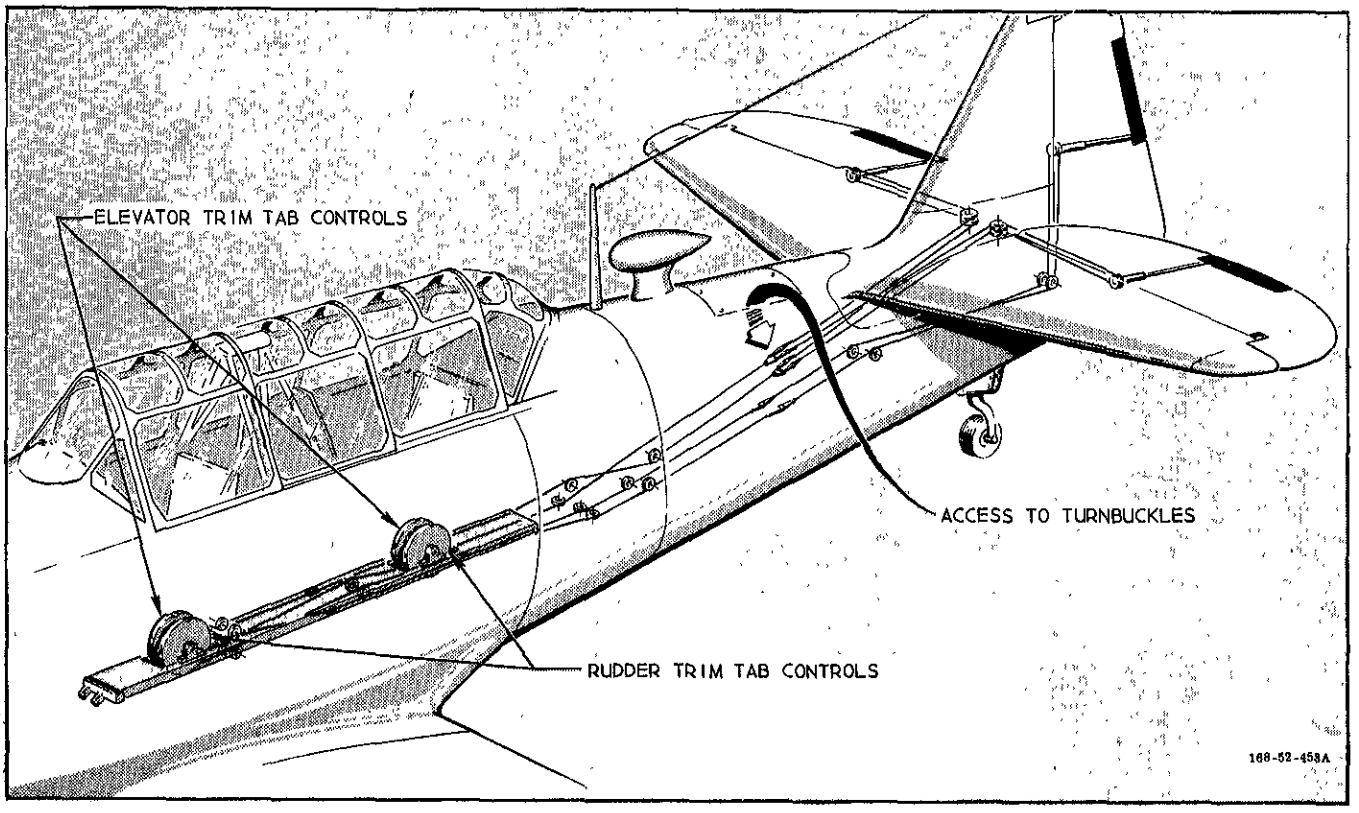


Figure 4-9 (Sheet 1 of 2 Sheets). Adjusting Elevator and Rudder Trim Tab Control Systems

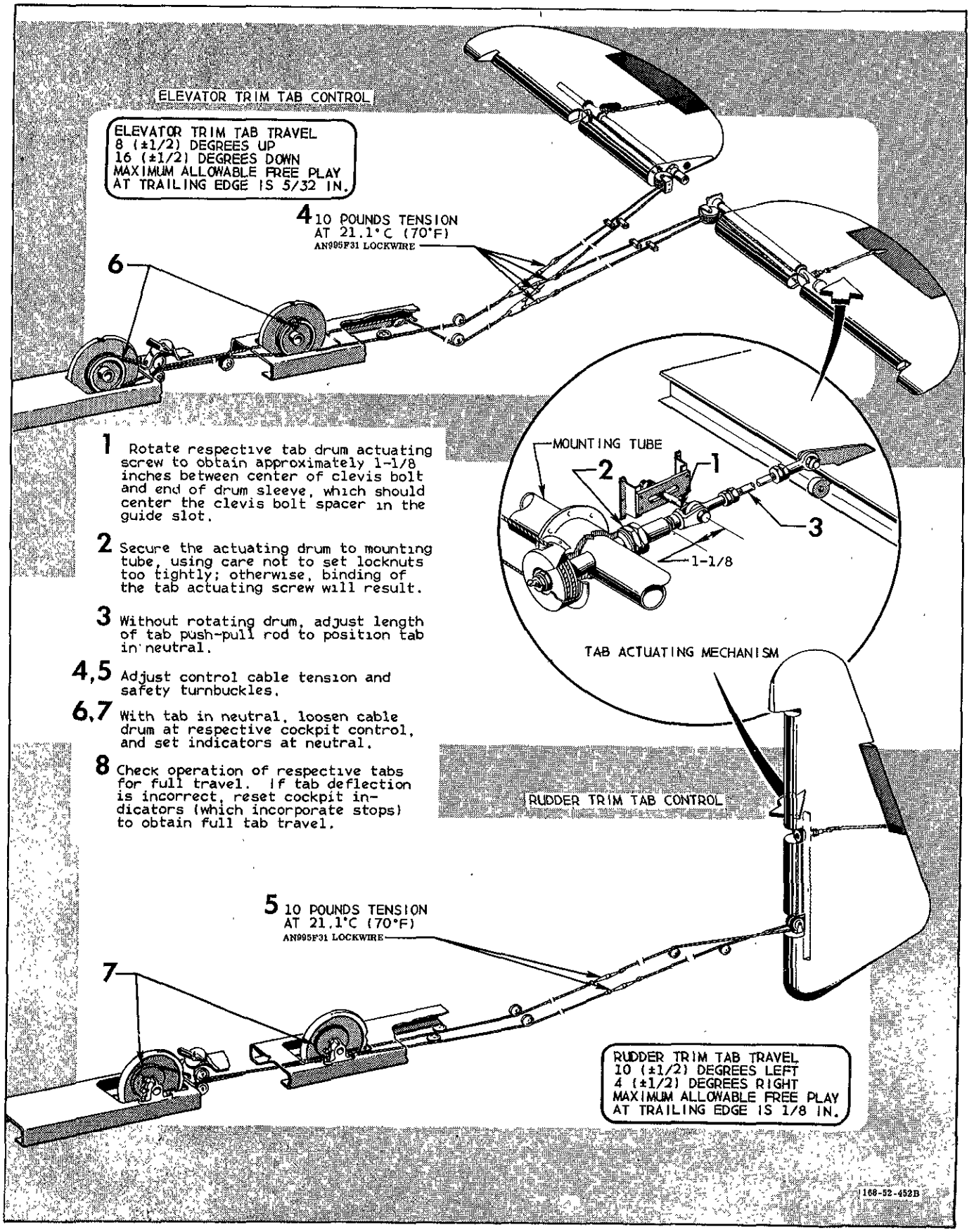


Figure 4-9 (Sheet 2 of 2 Sheets). Adjusting Elevator and Rudder Trim Tab Control Systems

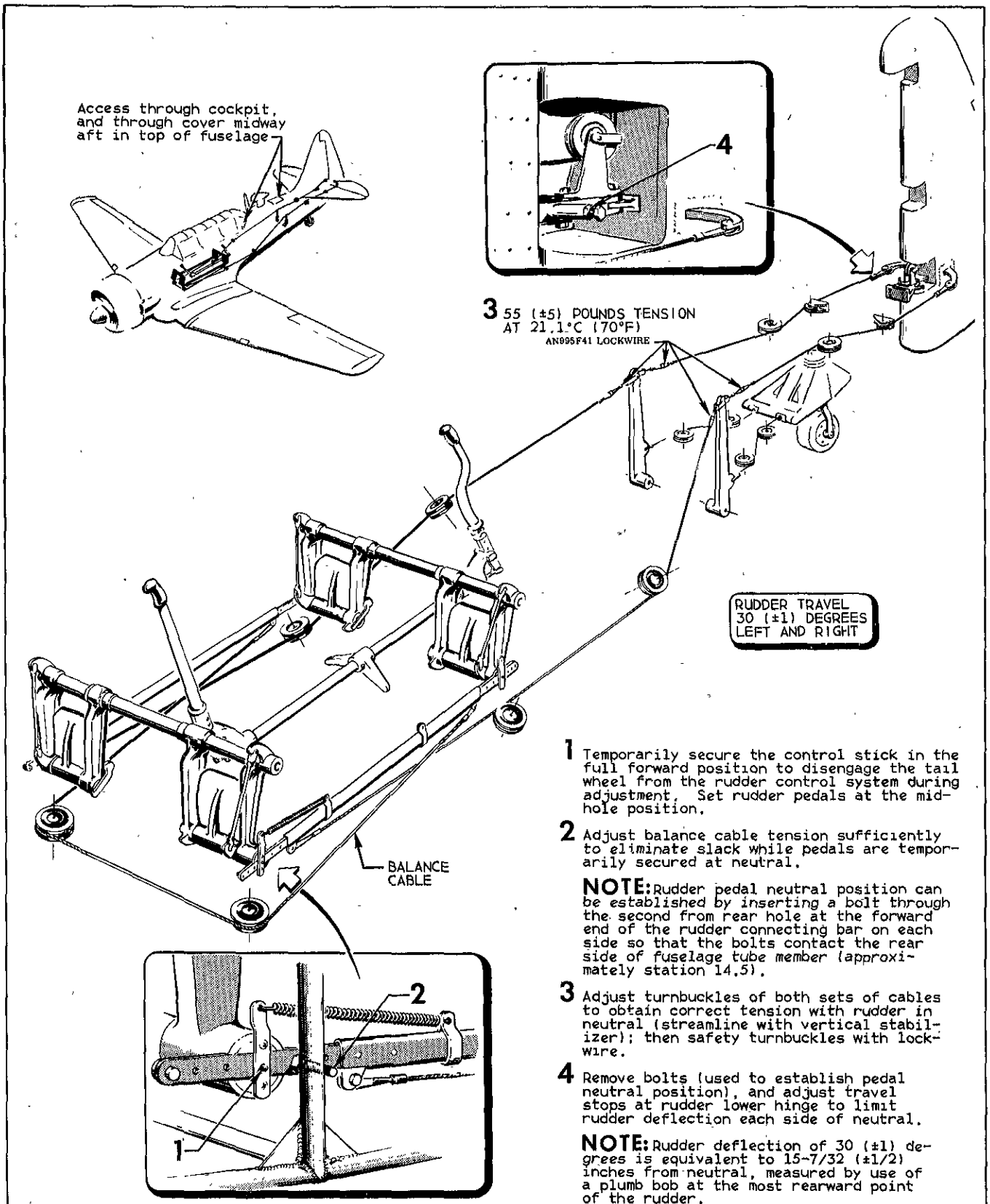


Figure 4-10. Adjusting Rudder Control System

permit attachment of the tail wheel steering cables. (Refer to paragraph 4-118.)

4-72. ADJUSTING RUDDER CONTROL SYSTEM. See figure 4-10.

4-73. TRIM TAB CONTROL SYSTEMS.

4-74. Trim tabs are incorporated on the elevators, rudder, and ailerons, to provide longitudinal, directional, and lateral trim, respectively. The elevator tabs and rudder tab are mechanically controlled and actuated from either cockpit through cables and drums. The control wheels for the elevator and rudder tabs are located on the left side of each cockpit, and incorporate stops that limit the angular travel of the tabs. The aileron tabs, which are ground-adjustable only, are secured in position by means of an adjustable rod attached to the aileron hinge point.

4-75. ADJUSTING ELEVATOR AND RUDDER TRIM TAB CONTROL SYSTEMS. See figure 4-9.

4-76. FUSELAGE.

4-77. The fuselage consists of two major components, a front (cockpit) section and a rear section, joined at station 107 by two bolts at each of four attaching points. A cockpit canopy with sliding sections is attached to the fuselage front section. Emergency exits are identified by orange and yellow markings.

4-78. FUSELAGE FRONT SECTION.

4-79. The fuselage front section consists of a welded chrome molybdenum steel tubular structure, and includes the firewall, front and rear cockpits, cockpit enclosure, and all cockpit controls. The fuselage front section attaches to the wing center section at four points by means of two bolts at each point, and extends from the firewall (station 0) to the rear cockpit. Two fixed steps are provided on the left side of the fuselage, one for each cockpit. These steps must be removed before the left side panel can be removed. Removable aluminum side panels, which are secured to the fuselage former channels, enclose the bay between the upper and lower longerons of the fuselage front section.

4-80. REMOVING FUSELAGE FROM WING CENTER SECTION. The parts and components referred to in the following procedure are identified in figure 4-11. Remove the fuselage as follows:

CAUTION

- To maintain balance of the wing with the fuselage removed, it will be necessary to remove the fairing between the wing center section and wing outer panel, and to place locally fabricated supports at the trailing edge of the attaching angles.

- Turn off all electrical power.

a. Remove all fuselage-to-wing fairing.

b. Disconnect all hydraulic lines.

c. Disconnect all electrical wiring at center section.

d. Disconnect aileron control cables at bell crank, flap position indicator cable at flap, and landing gear position indicator cables at the indicator.

e. Disconnect landing gear lock push-pull rods in wheel well.

f. Disconnect fuel and pitot lines.

fA. On Airplanes AF49-3538 through AF49-3596 with droppable fuel tank provisions, disconnect air pressure line and electrical connection; then disconnect tank emergency release cable and remove supporting clips so that cable is not attached to the wing center section.

g. Remove cotter keys from universal yoke of fuel selector valve.

h. Remove canopy. (Refer to paragraph 4-87.)

i. Remove cotter keys and nuts from attaching bolts and, with a bar inserted through the overturn truss, hoist fuselage. The weight of the fuselage with the engine installed is approximately 1950 pounds.

4-81. ATTACHING FUSELAGE TO WING CENTER SECTION. See figure 4-11.

4-82. FUSELAGE REAR SECTION.

4-83. The fuselage rear section is of all-metal semi-monocoque construction, and extends from the rear cockpit aft. A cover midway aft in the top of the fuselage permits access to the enclosed electronic equipment and the cables routed through the rear section. An all-metal baggage compartment, access to which can be gained through a door on the left side of the fuselage, is provided just aft of the rear cockpit. A lift-mooring tube, forward of the tail surfaces, is provided to enable hoisting the aft end of the fuselage by means of a one-inch diameter bar.

4-84. REMOVING FUSELAGE REAR SECTION. The parts and components referred to in the following procedure are identified in figure 4-12. Remove the rear section as follows:

CAUTION

To maintain proper balance of the airplane with the engine installed and the rear section removed, it will be necessary to add 250 pounds of weight in the rear cockpit seat, and the wing trailing edge must be supported as shown in figure 4-11.

a. Place locally fabricated support under fuselage at station 137.

b. Remove fuselage lower access section.

c. Remove screws from rear edge of fuselage side panels.

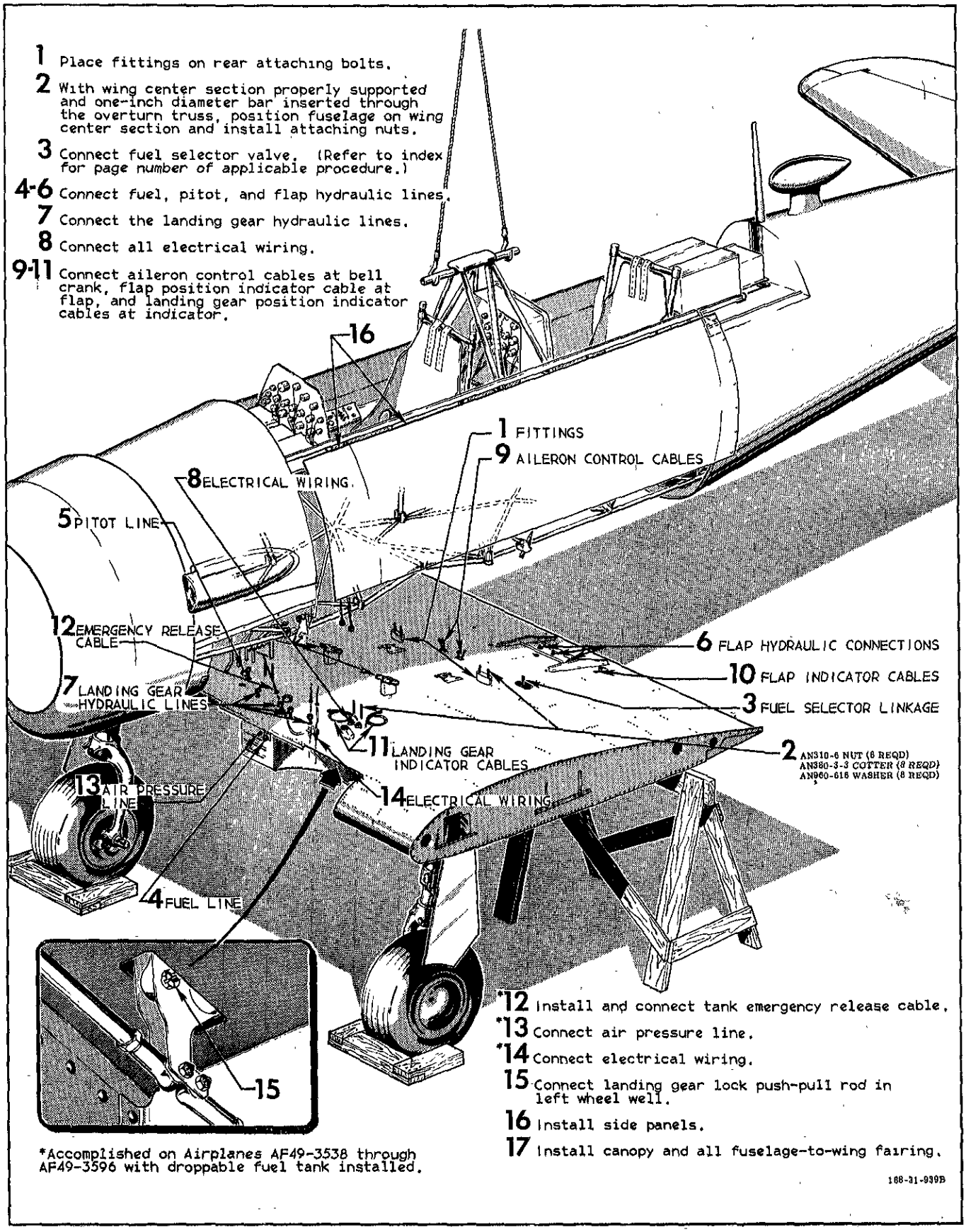


Figure 4-11. Attaching Fuselage to Wing Center Section

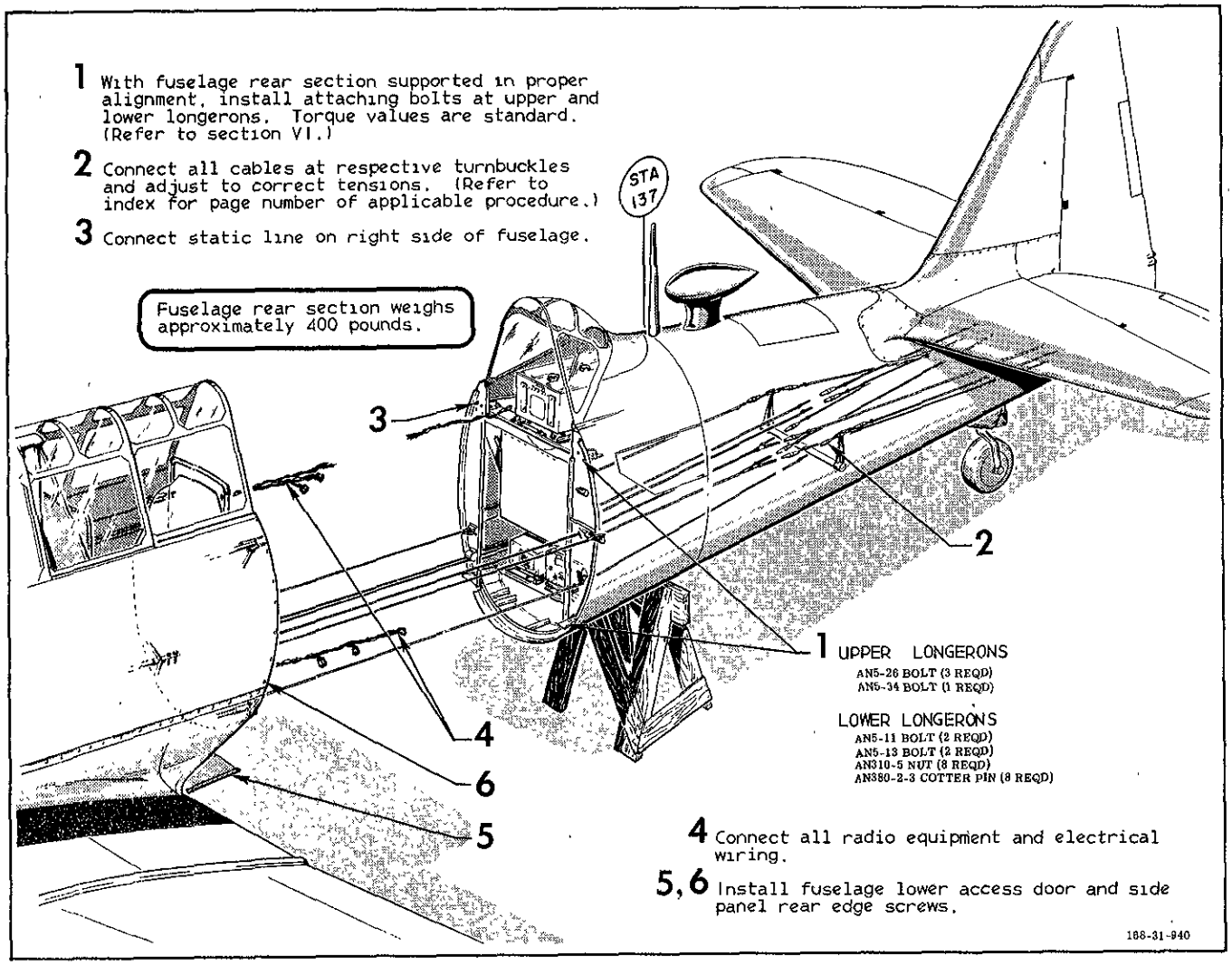


Figure 4-12. Attaching Fuselage Rear Section

d. Disconnect all radio equipment and electrical wiring.

e. Disconnect all cables at nearest turnbuckle.

f. Disconnect static line on right side of fuselage.

g. Remove attaching bolts and separate fuselage rear section, which weighs approximately 400 pounds.

4-85. ATTACHING FUSELAGE REAR SECTION. See figure 4-12.

4-86. CANOPY.

4-87. The canopy, which encloses the two tandem cockpits, consists of pilot's windshield, a stationary mid-section, two sliding sections, and a stationary rear section. The pilot's windshield has three panels; the center panel is 1/4-inch laminated glass, and the two fixed side panels are 3/16-inch laminated plate glass. The canopy side panels also are plate glass and the top panels are clear-vision plastic. Each manually operated sliding section is guided by a set of tracts that are attached to the fuselage by screws. The sliding sections can be locked in three positions (open, closed, and intermediate) and are secured in the respective positions by a handle and lever arrangement located on the left side of each sliding section. When removing the front or rear sliding sections, it is necessary to first remove the windshield or the rear stationary section, respectively. The stationary mid-section can be removed only after sliding sections have been removed.

4-88. LANDING GEAR.

4-89. The main landing gear, supported by a trunnion fitting on the front spar of the wing center section, is retracted (inboard) and extended by hydraulic system pressure. The gear can be lowered, in the event of hydraulic failure, by mechanically releasing the control linkage and allowing the gear to free-fall. The steerable tail gear is not retractable. Mechanically actuated up-lock hooks and down-lock pins are automatically positioned by control rod linkage connected to

the landing gear control handles. Landing gear operation can be controlled to the "UP" or "DOWN" position from the front cockpit, but the gear can be positioned only to "DOWN" by the aft cockpit control handle. The front cockpit control handle must be pulled inboard to clear the "DOWN" position indent in the control quadrant before handle can be moved to the "UP" position. A mechanically operated, finger-type gear position indicator, mounted on the forward left side of the front cockpit, is connected and controlled by cables attached to each main gear. Two green position indicator lights are provided in the front and rear cockpits to give a safe indication of the gears down and locked. A white external position indicator light, mounted adjacent to each main landing gear, will go on when the respective gear is down and locked and the navigation lights are operating. An aural warning horn sounds whenever the throttle is closed and the landing gear is not in the "DOWN" position. The tail gear is locked in the steerable position at all times, except when the control sticks are in the forwardmost position. Steering is accomplished by control cables, attached to the rudder control idler arms and operated by movement of the rudder pedals.

4-90. LANDING GEAR OPERATION.

4-91. Positioning of either landing gear control handle to the "DOWN" position releases the up-lock hooks of the main gear by mechanical linkage. The linkage also positions the power control valve and landing gear control valve to direct hydraulic pressure from the engine-driven pump to the down-side of the gear actuating cylinders. As the gear is fully extended, a prepositioned spring-loaded down-lock pin slides into place, locking the gear. Cables from each gear are attached to the finger-type gear position indicator in the front cockpit, indicating a safe condition of each gear down and locked. Switches, mounted adjacent to each landing gear, are also contacted to close the electrical circuits to the green indicator lights in each cockpit and to provide an added indication of a safe gear condition. After the allowable time-lag has elapsed, the power control valve automatically disengages, to depressurize the landing gear system and direct pump hydraulic pressure into the reservoir return line. Retraction of the landing gear can be accomplished only from the front cockpit, as a safety indent is provided on the control quadrant for locking the control handle in the "DOWN" position. Pulling the control handle inboard, to clear the indent, and then moving it to the "UP" position, will release the spring-loaded down-lock pins by mechanical linkage. The linkage also positions the hydraulic power control valve and landing gear selector valve to direct hydraulic pressure to the up-side of the gear actuating cylinders. As each gear is fully retracted, the up-lock hooks that have been previously positioned by springs and mechanical linkage from the control handles, are moved forward by the gear up-lock rollers and returned to the locked position. Cable linkage controlling the position indicator will move the indicator to show an up-and-locked condition. After the allowable time-lag has elapsed, the power control valve automatically disengages to depressurize the landing gear system and direct hydraulic pump pressure into the reservoir return line. In the event of hydraulic pressure failure, positioning either landing gear control handle to "DOWN" will mechanically release the up-lock hooks, allowing the gear to free-fall to the down-and-locked condition. Cable linkage controlling the position indicator will move the indicator to show a down-and-locked condition. (See figure 4-13.)

4-92. TROUBLE SHOOTING LANDING GEAR SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Gear fails to extend or retract.	Defective power control valve.	Replace.
	Defective control valve.	Replace.
	Linkage from control handle to power control valve, or selector valve out of adjustment.	Adjust.
	System relief valve remaining open.	Adjust, or replace.
	Time-lag unit in power control valve failing to operate.	Replace time-lag needle valve.
	Linkage from control handle to up-lock hooks and down-lock pins out of adjustment.	Adjust.
Gear fails to lock in the fully extended or retracted position.	Linkage from control handle to up-lock hooks and down-lock pins out of adjustment.	Adjust.

TROUBLE	PROBABLE CAUSE	REMEDY
Gear travel uneven.	System relief valve setting too low.	Adjust.
	Bent piston in gear actuating cylinder.	Replace.
Control handle moves too freely.	Loose selector valve plunger rod packing nut.	Tighten nut.
Stiffness in movement of control handle.	Tight selector valve plunger rod packing nut.	Loosen nut.
	Lockpin mechanism control rod rubbing on fairlead on rib in landing gear bay.	Rework fairlead to free control rod.
Landing gear indicator arms set too high or too low in "UP" or "DOWN" position.	Improper rigging of indicator arm cables.	Rig cables properly.
	Indicator arm linkage fouling end of control shelf.	Adjust linkage.

4-93. ADJUSTING LANDING GEAR CONTROL LINKAGE.

4-94. See figure 4-13.

4-95. MAIN LANDING GEAR ASSEMBLY.

4-96. The gear assemblies pivot about trunnion pins mounted on the front spar of the wing center section. The shock struts are of the combined hydraulic and pneumatic type. (For servicing instructions for the landing gear shock struts, refer to paragraphs 3-36 through 3-40.)

4-97. REMOVING LANDING GEAR. To remove the landing gear, proceed as follows:

a. Place airplane on jacks.

b. To release down-lock pin, set the landing gear control handle to the "UP" position.

c. Disconnect flexible electric conduit from inboard side of center section end plate, and from center section leading edge.

d. Disconnect cold air duct line from wing leading edge section (left-hand side only).

e. To remove wing leading edge assembly from center section, remove bolts, screws, and fairing as required.

f. Disconnect shock strut fairing attaching link rod from shock strut.

g. Disconnect landing gear position indicator cable from lower rear side of strut attaching fitting.

h. Loosen the locknut on actuating cylinder piston rod, and rotate piston rod until it becomes disengaged from the clevis end attached to shock strut.

i. Disconnect the flexible brake line from the shock strut support fitting by removing the attaching bolt.

j. Disconnect hydraulic brake lines.

k. Remove lock bolt, retaining nut and trunnion pin.

l. Swing landing gear shock strut slightly inboard to allow locking lug to disengage from lock fitting, and slide strut attaching fitting from trunnion pin.

4-98. INSTALLING LANDING GEAR. See figure 4-14.

4-99. LANDING GEAR UP-LOCK HOOKS.

4-100. The landing gear up-lock hooks are mounted on the fuselage, directly forward of the firewall, in the inboard forward section of each wheel well. Spring-loaded to the locked condition, the hooks are mechanically unlocked by linkage attached to the landing gear control handles. Placing of either landing gear control handle to "DOWN," positions the linkage to overcome the spring tension and move the hooks into an unlocked condition. Placing of control handle in the forward cockpit to "UP," positions the linkage to allow spring tension to move the hooks into a locked condition, pre-positioning the hooks to receive the up-lock rollers on the landing gear strut.

4-101. ADJUSTING LANDING GEAR UP-LOCK HOOKS. See figure 4-13.

4-102. LANDING GEAR DOWN-LOCK PINS.

4-103. The landing gear down-lock pins are mounted directly above the landing gear trunnion pin and

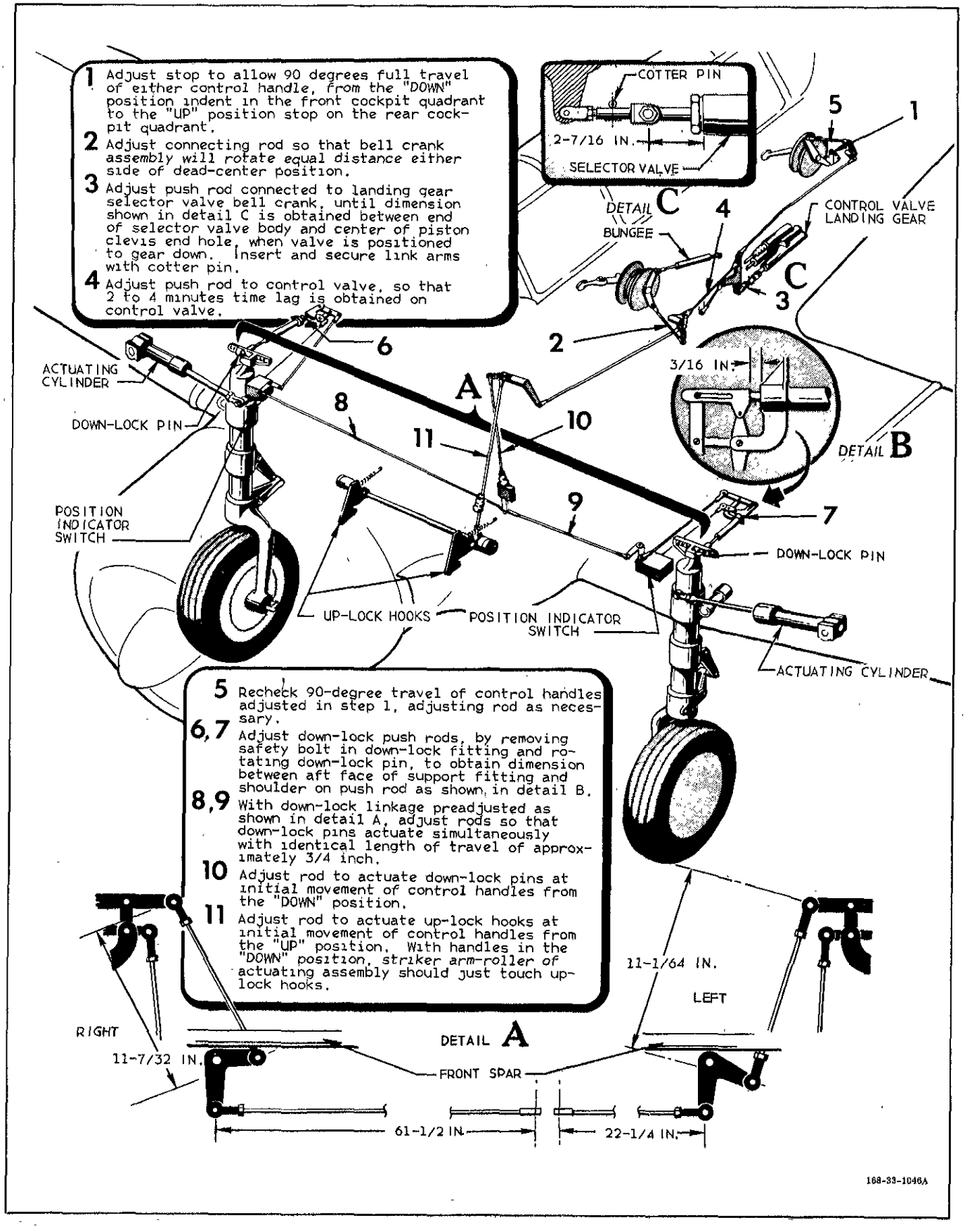


Figure 4-13. Landing Gear Control System Linkage Adjustment

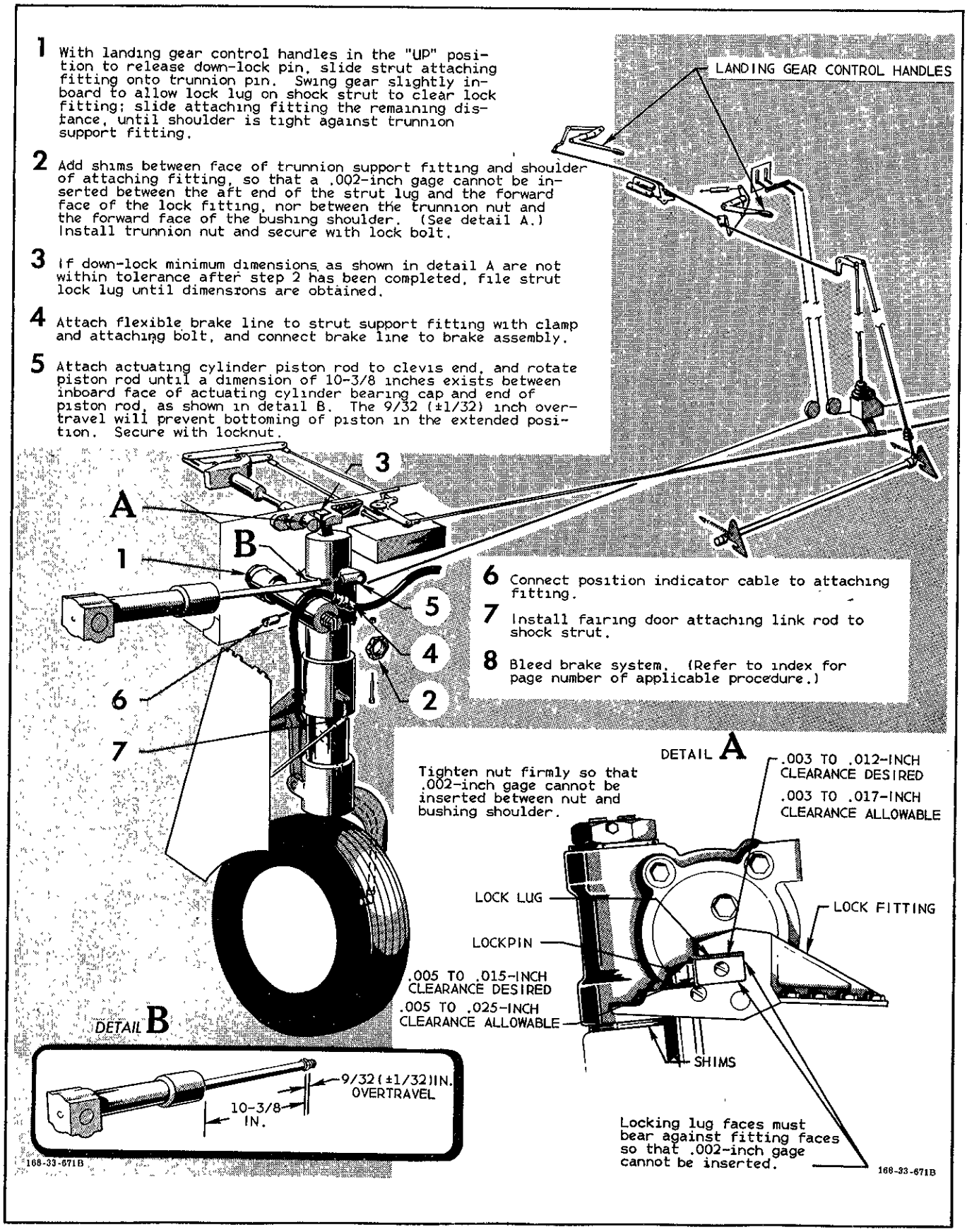


Figure 4-14. Installing and Adjusting Landing Gear

the refinished area to dry before remounting the tube and casing. Surface oil and grease should be removed by washing with a mild soap solution, or wiping with a cloth moistened in naphtha or solvent. Nylon casings will stretch upon initial inflation, usually within 24 hours. To prevent this condition, mount and inflate new nylon casings as long a time as possible prior to installation on airplane. In the event a flat spot occurs after installation, move the airplane until the low spot is at the top of the casing, and increase normal air pressure 50 percent for 30 minutes. Deflate to normal pressure, and if the condition still exists, repeat the operation. If an airplane is to remain idle for a period, move airplane every 3 days, or block to sufficient height to remove weight from the casing.

4-113. MAIN LANDING GEAR POSITION INDICATOR SYSTEM.

4-114. Mechanically operated, finger-type gear position indicators are mounted on the forward left side of the front cockpit. The indicators are controlled by cables attached directly to the strut trunnion fitting of each main landing gear. Movement of the gear to the up position or down position is transmitted by the cables to the position indicator, providing a visual check of the condition of the gear at all times. Two green lights in each cockpit (lights are adjacent to the position indicator in the front cockpit, and on the left side of the rear cockpit), controlled by switches located inboard from the down-lock pins, are illuminated when the gear is in the down-and-locked position. A white external indicator light (installed adjacent to each main landing gear, on the center section) is provided to indicate a safe down-and-locked condition,

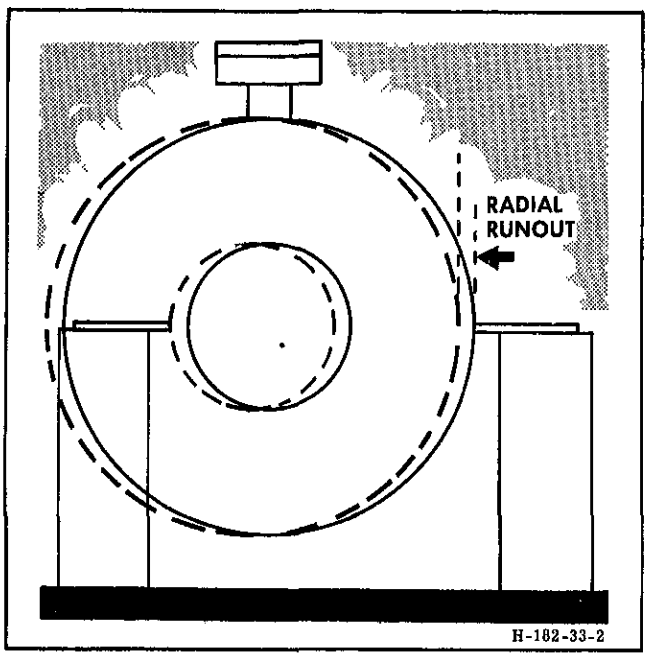


Figure 4-14B. Radical Run-out

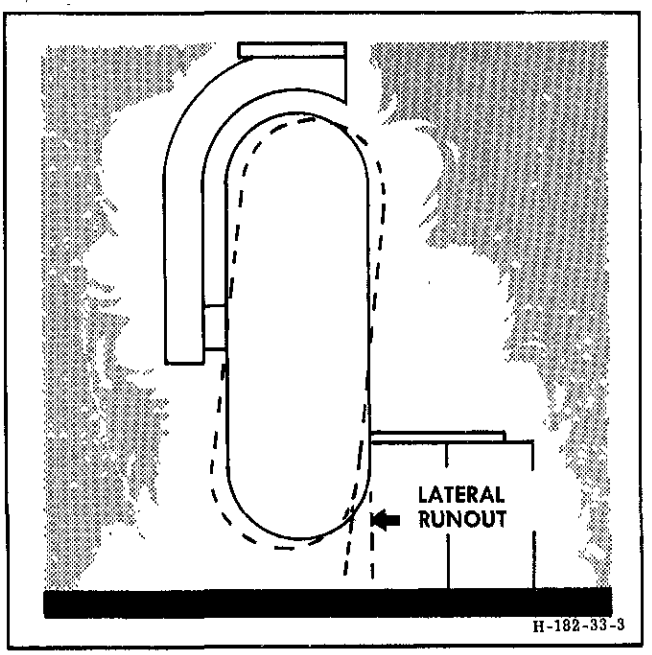


Figure 4-14C. Lateral Run-out

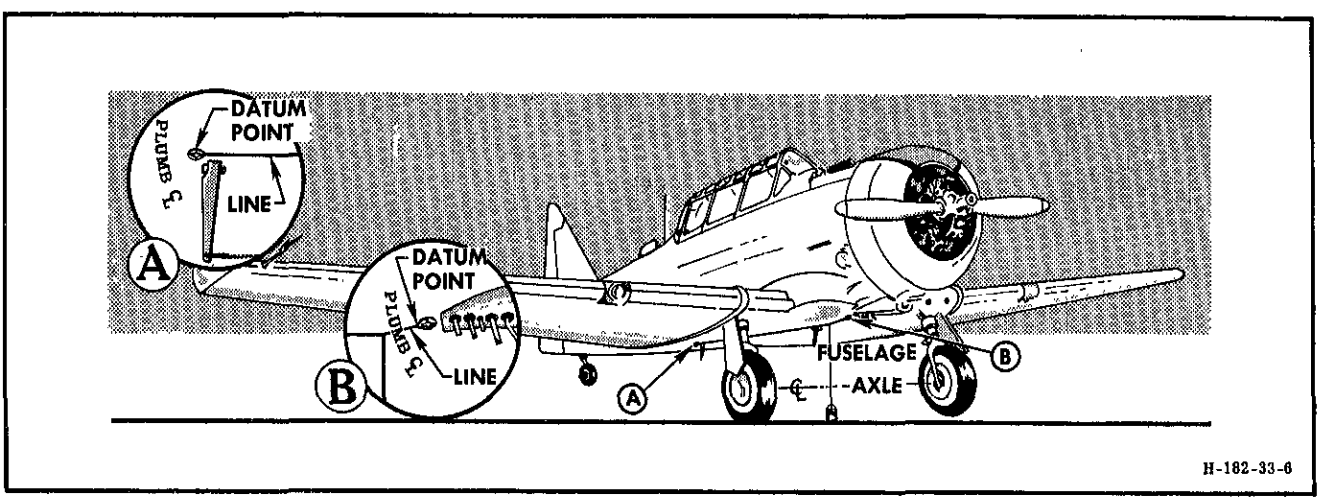


Figure 4-14D. Locating the Plumb Line

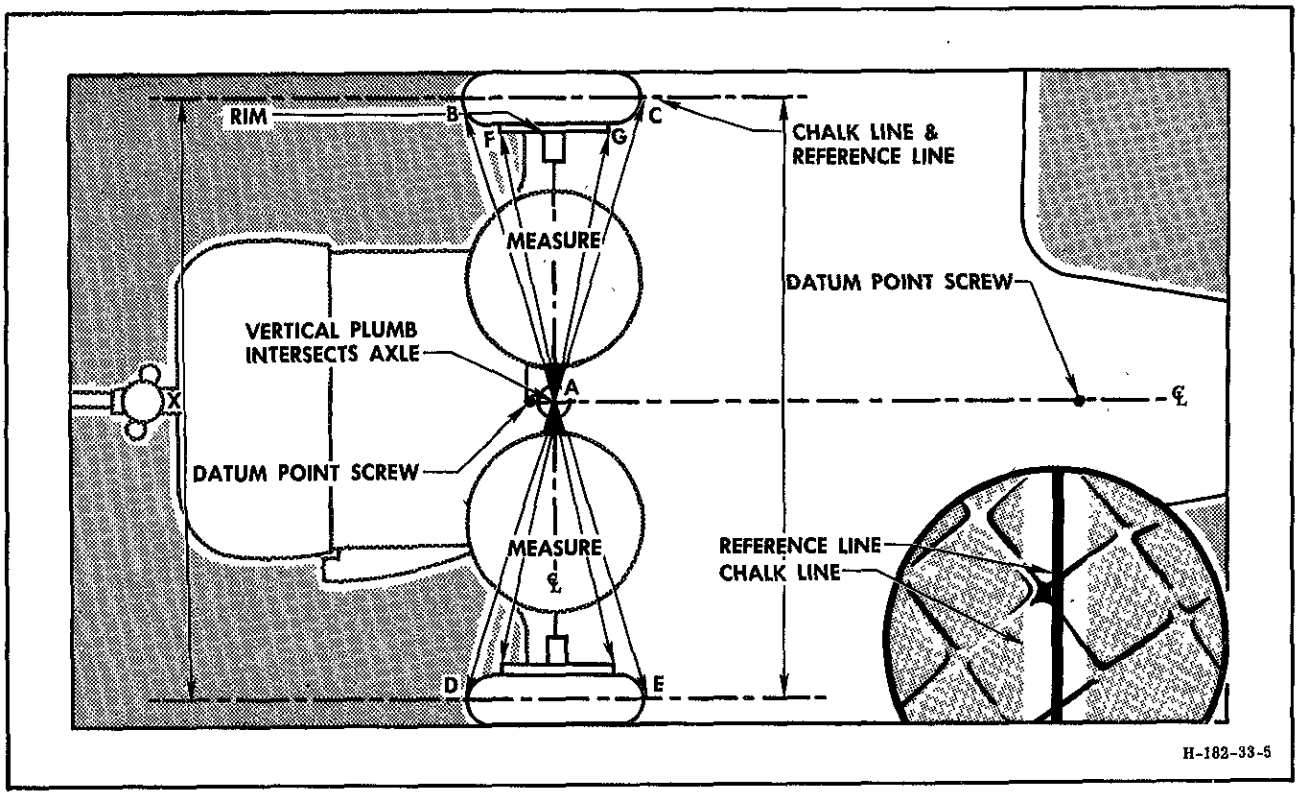


Figure 4-14E. Location of Measurement Points for Toe-in and Toe-out

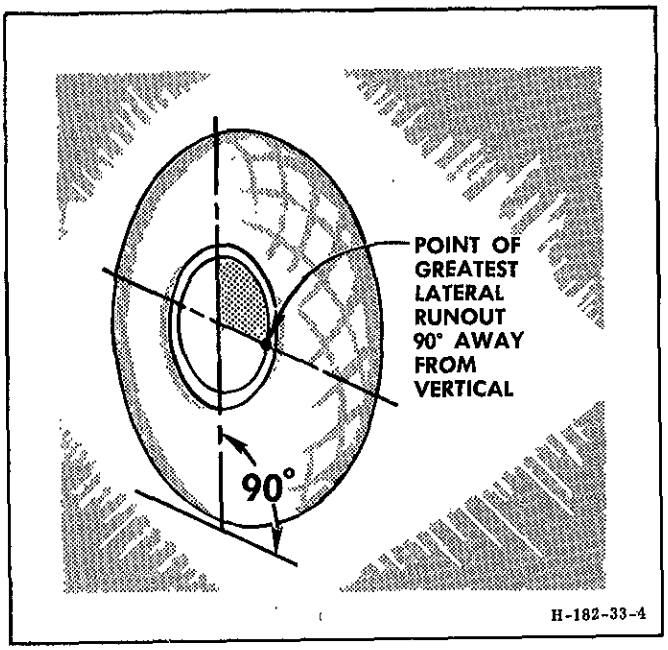


Figure 4-14F. Measurement of Camber

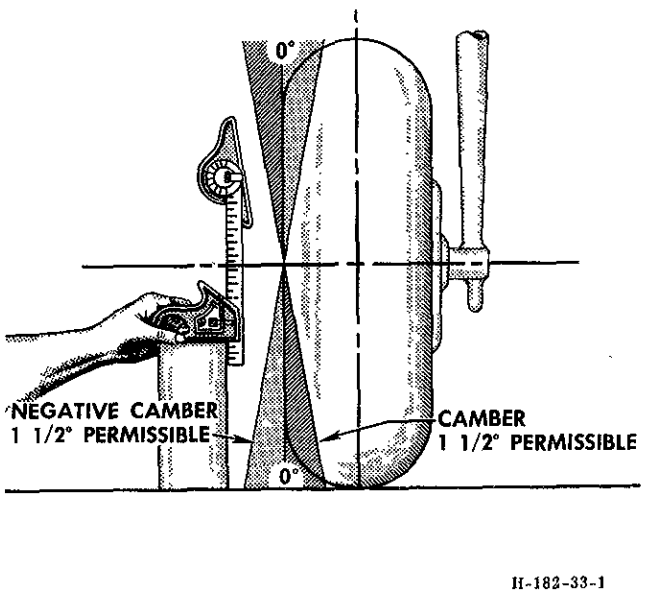


Figure 4-14G. Determining Camber or Negative Camber

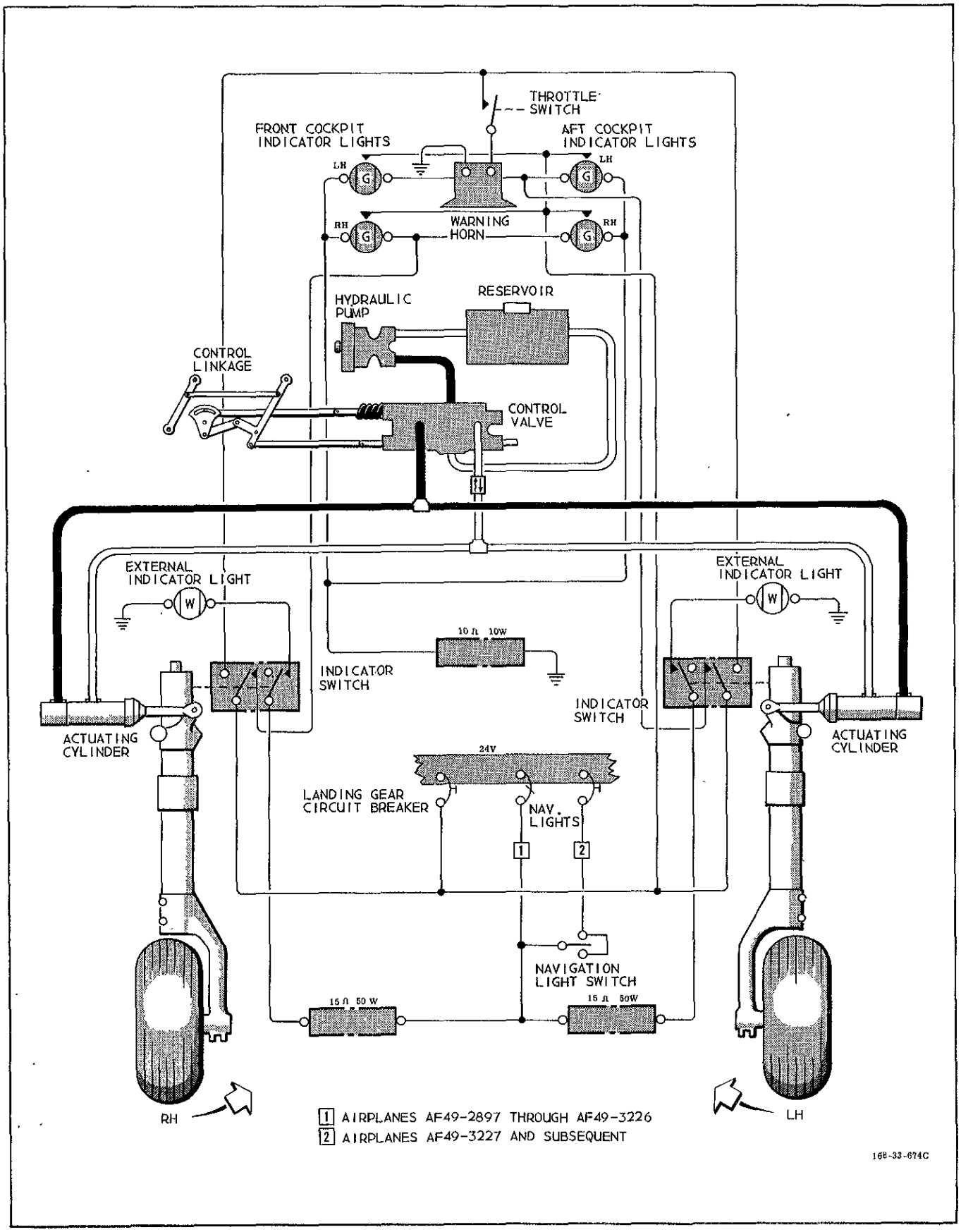


Figure 4-15. Landing Gear Hydraulic System and Position Indicating Electrical System

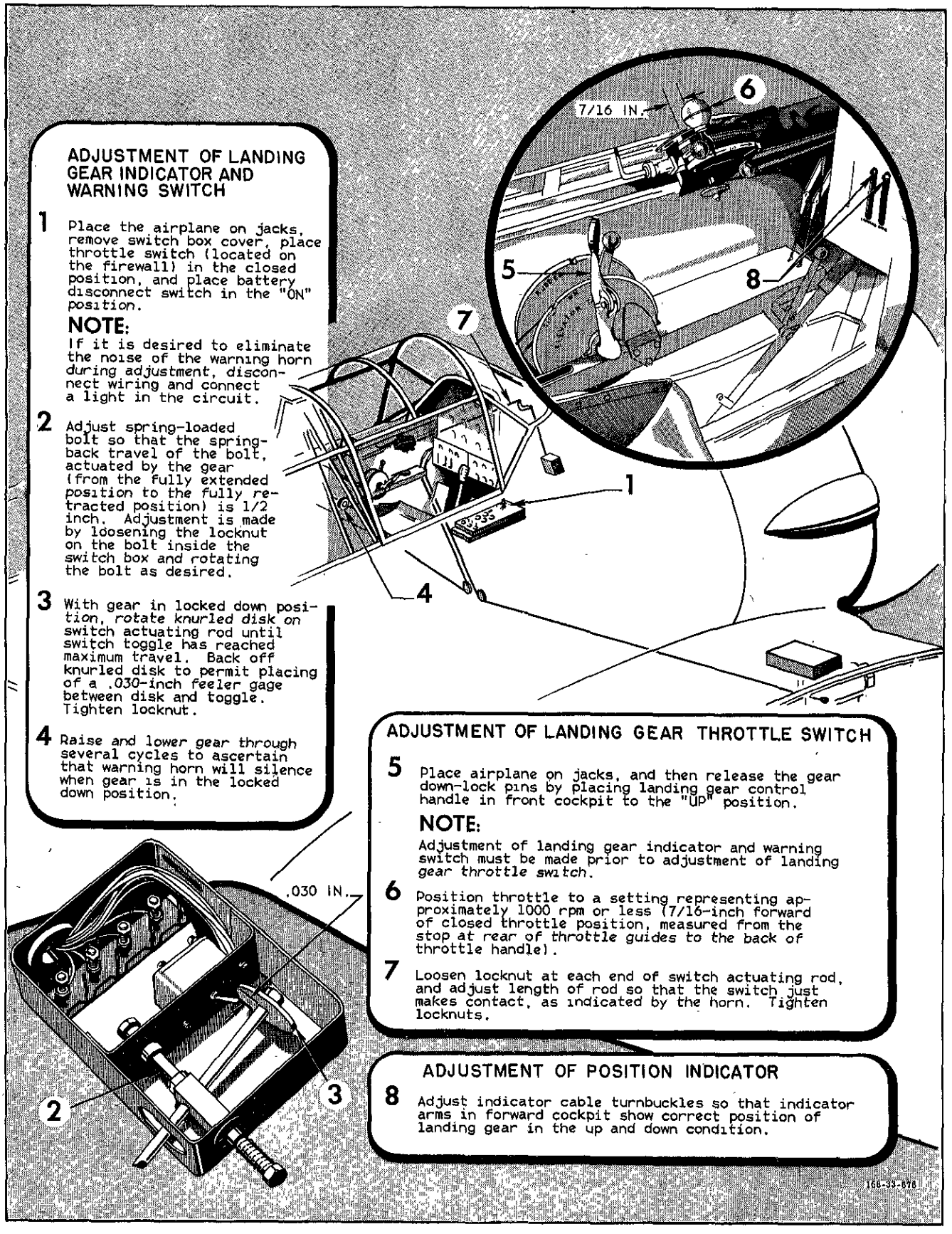
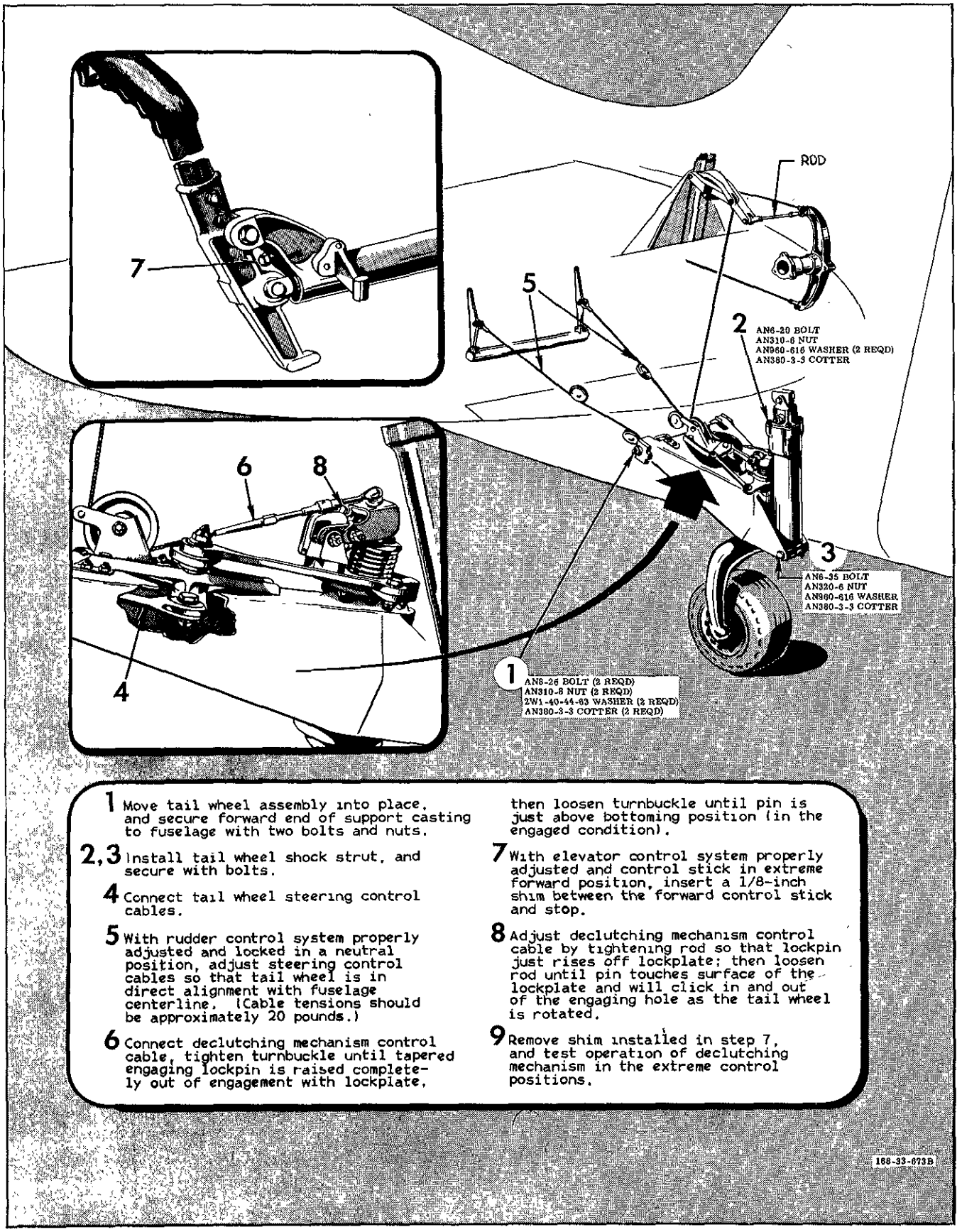


Figure 4-16. Adjusting Landing Gear Position Indicating System



1 Move tail wheel assembly into place, and secure forward end of support casting to fuselage with two bolts and nuts.

2,3 Install tail wheel shock strut, and secure with bolts.

4 Connect tail wheel steering control cables.

5 With rudder control system properly adjusted and locked in a neutral position, adjust steering control cables so that tail wheel is in direct alignment with fuselage centerline. (Cable tensions should be approximately 20 pounds.)

6 Connect declutching mechanism control cable, tighten turnbuckle until tapered engaging lockpin is raised completely out of engagement with lockplate, then loosen turnbuckle until pin is just above bottoming position (in the engaged condition).

7 With elevator control system properly adjusted and control stick in extreme forward position, insert a 1/8-inch shim between the forward control stick and stop.

8 Adjust declutching mechanism control cable by tightening rod so that lockpin just rises off lockplate; then loosen rod until pin touches surface of the lockplate and will click in and out of the engaging hole as the tail wheel is rotated.

9 Remove shim installed in step 7, and test operation of declutching mechanism in the extreme control positions.

Figure 4-17. Installing and Adjusting Tail Wheel

when the navigation lights are operating. A warning horn is also incorporated in the system, to indicate an unsafe condition, in that the landing gear is not extended when the throttle has been closed. (See figure 4-15.)

4-115. ADJUSTING POSITION INDICATING SYSTEM. See figure 4-16.

4-116. TAIL WHEEL.

4-117. The tail wheel assembly consists of a 12-1/2 inch channel-tread tail wheel tire, tail wheel fork, shock strut, declutching mechanism, and steering control cables. The tail wheel assembly, located in the bottom aft section of the fuselage, is free-swiveling, steerable, and nonretractable. The tail wheel, during engagement of the declutching mechanism, is steerable 15 degrees either side of the centerline of the airplane, when full rudder deflection of 30 degrees is applied. The rudder to tail wheel ratio is 2 to 1.

4-118. TAIL WHEEL STEERING OPERATION. The tail wheel is locked in the steerable position at all times, except when the control sticks are in the forwardmost position. A declutching mechanism (steering release) is attached to the elevator torque tube by cable linkage. Rotation of the elevator torque tube as the elevators travel to the down position gradually pulls the declutching control cable, releasing the lockpin. When the control sticks have been moved to their forwardmost position and the elevators are full down, the declutching mechanism is released to allow free-swiveling of the tail wheel. When the declutching mechanism is engaged, tail wheel steering is accomplished by action of the rudder pedals. Steering control cables from the steering arm are attached to the rudder cable system, so that movement of the rudder cables also controls movement of the tail wheel steering mechanism. A shock strut, connecting the aft end of the tail wheel support casting to the fuselage structure, absorbs impact loads and shocks applied during landing operations.

4-119. ADJUSTING TAIL WHEEL STEERING SYSTEM. See figure 4-17.

4-120. REMOVING TAIL WHEEL ASSEMBLY. To remove the tail wheel assembly, proceed as follows:

a. Place a jack under aft section of fuselage, so that tail wheel is off the ground.

b. Disconnect declutching release cable from declutching head.

c. Disconnect steering control cables from rudder idler arms.

d. Remove attaching bolt connecting shock strut to support casting.

e. Remove two attaching hinge bolts that connect the tail wheel support casting to the fuselage, and remove tail wheel assembly.

4-121. INSTALLING TAIL WHEEL ASSEMBLY. See figure 4-17.

4-122. BRAKE SYSTEM.

4-123. The brake system consists of a master brake cylinder unit containing a brake system reservoir and two independent master brake cylinders, and interconnecting cable control linkage and hydraulic lines. The brakes are of the internal expansion type, with brake shoes and operating cylinders installed on each main landing gear. Hydraulic fluid is supplied to the master brake cylinder reservoir from the main hydraulic power system reservoir. During normal operation, brakes are applied by depressing the rudder toe pedals. Brake pressure can be independently applied to either of the main landing gear brake units by depressing the corresponding brake pedal. A parking brake control handle in the front cockpit is interconnected with the master brake cylinder parking brake valve mechanism by means of a cable and pulley linkage. (See figure 4-18.)

4-124. BRAKE SYSTEM OPERATION.

4-125. Fluid is directed from the main hydraulic power system reservoir to automatically fill the master brake cylinder unit reservoir. Actuation of the master cylinders, through cabin and connecting rod linkage, is obtained by movement of the rudder toe pedals. Action of the pistons in the master cylinders displaces fluid from the cylinders through hydraulic lines to the brake shoe operating cylinders. This fluid forces two actuating pistons outward against the ends of the brake shoes, thus expanding the shoes against the brake drums. When the pressure is released, the spring-loaded ends of the brake shoes retract, forcing the pistons back into the operating cylinders. As the pistons move inward toward the center of the cylinder, fluid is displaced and returns to the master cylinder unit reservoir. A fluid expansion chamber is provided in each master brake cylinder.

4-126. TROUBLE SHOOTING BRAKE SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Uneven braking action with equal pedal pressure.	Oil on linings.	Wash or replace linings.
	Brakes not adjusted evenly.	Adjust.
	Linings worn unevenly.	Replace linings.

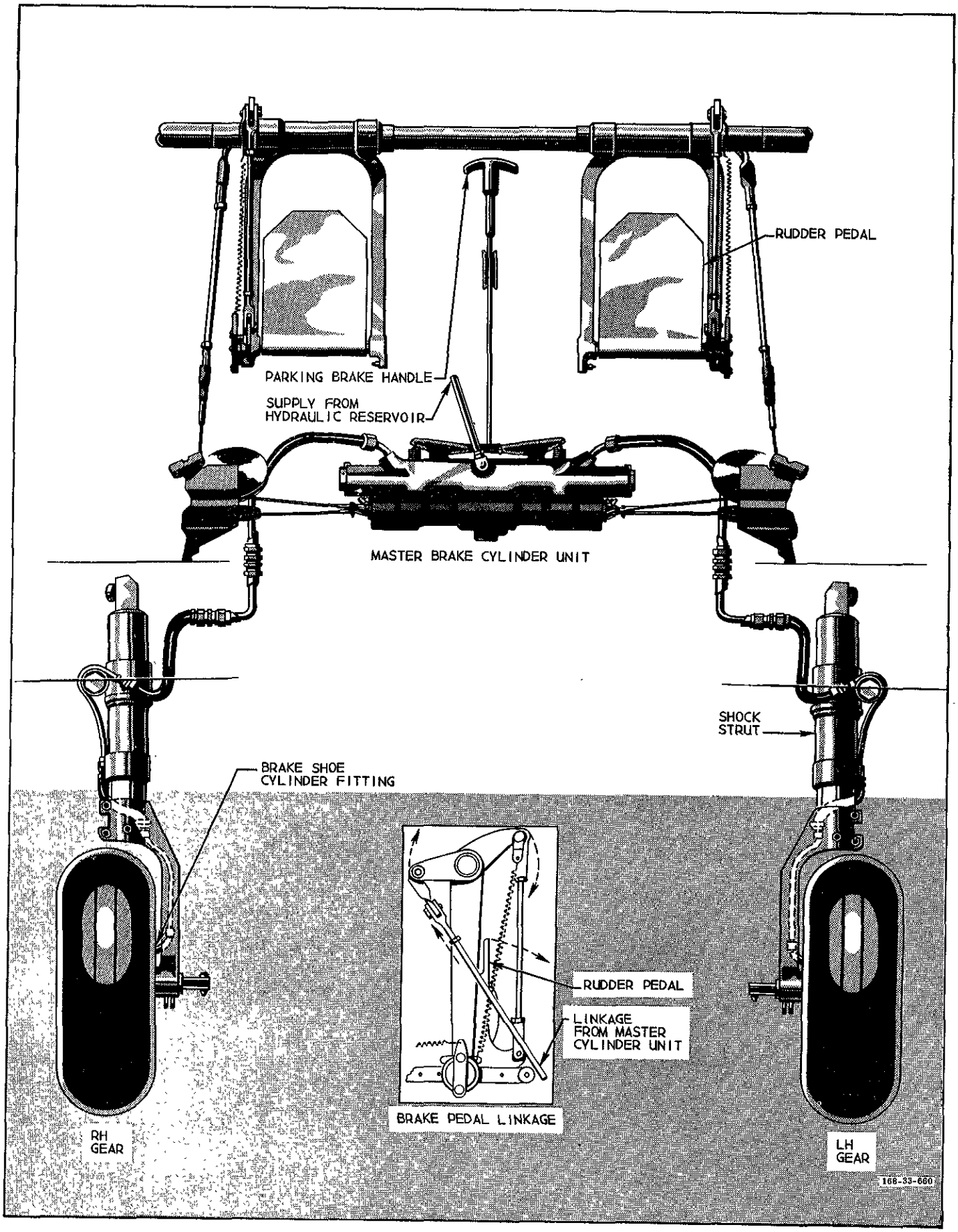
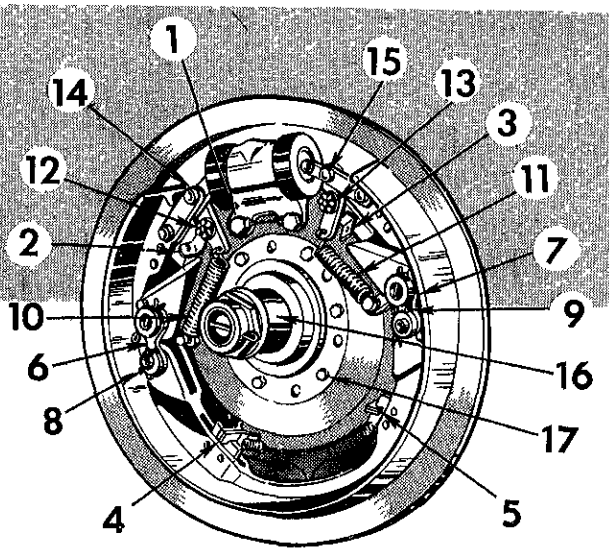
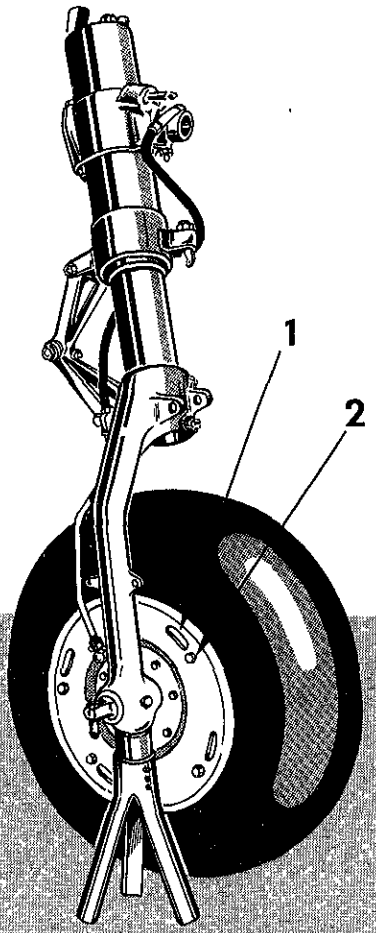


Figure 4-18. Brake System

ASSEMBLING BRAKE UNIT

1 Attach operating cylinder to torque plate and secure.
2-5 Slide brake shoes under adjusting bell cranks.
6,7 Install links.
8,9 Insert pins and secure with cotter pins.
10,11 Install spring, insert pins, and safety.
12,13 Position links.
14,15 Insert attaching pins and safety.





INSTALLING BRAKE UNIT

16 Slide brake onto landing gear axle until torque plate is flush with axle flange.
17 Insert attaching bolts.

ADJUSTING BRAKE UNITS

1 Place airplane on jacks, uncover the four inspection holes on inboard side of wheel fairing, and then insert a .010-inch thickness gage through each inspection hole, between brake lining and drum.
2 Turn adjustment screw adjacent to each inspection hole for adjustment. (Turn clockwise to decrease clearance, or counterclockwise to increase clearance.)

CHECKING BRAKE UNITS

1 *Spin wheels rapidly, and apply the brakes; both wheels should* stop simultaneously.
2 Apply parking brakes, and ascertain that both wheels are locked.
3 Release brakes; both wheels should rotate freely without drag.
4 If the brakes drag when the weight of the airplane is put on the *wheels, the radial clearance between the high spot on the drum* and the lining should be readjusted to .010 inch while the wheels are resting on the ground. Normally, the radial clearance at the top of the drum will increase and the radial clearance at the bottom of the drum will decrease, because a small amount of clearance is taken up by the wheel bearings. Pressure needed to apply the brakes should be equal when both brakes are applied.
5 *With foot pedals fully* depressed, brakes should hold airplane when engine is at full rpm.
6 If the lining is greasy or worn within 1/32 inch of the rivet heads, the lining will be replaced.

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Figure 4-20. Assembling, Installing, and Adjusting Brake Assembly

operates a sliding piston, which seals fluid from the unit reservoir into a pressure chamber. This pressure is transmitted to the brake shoe operating cylinder. Releasing the rudder toe pedal allows the spring-loaded piston to return to the open position, porting return fluid from the operating cylinder to the unit reservoir. An expansion chamber in the unit allows for thermal expansion of the trapped fluid when the parking brakes are applied. (See figure 4-19.)

4-132. BRAKE SHOE OPERATING CYLINDERS.

4-133. A brake shoe operating cylinder is located in each of the brake assemblies on the main landing gear, between the ends of the brake shoes. Fluid under pressure is displaced from the master cylinder unit to the brake shoe operating cylinder, forcing two actuating pistons outward against the brake shoes. This action of the brake shoes expands the brake lining to contact the brake drum. When pressure is released, the spring-loaded pistons retract into the cylinder, displacing the fluid back to the reservoir and releasing pressure on the brake shoe.

4-134. BRAKE ASSEMBLIES.

4-135. The brake assembly, consisting of the operating cylinder and brake shoes, is mounted on a torque plate which in turn is bolted to the axle flange. The brake drum, bolted to the landing gear wheel, revolves around the brake shoe. Extending the actuating pistons in the cylinder expands the brake shoes and forces the lining against the drum.

4-136. REMOVING BRAKE ASSEMBLY. To remove the brake assembly, proceed as follows:

a. With airplane on jacks, remove main landing gear wheel.

b. Disconnect hydraulic line at operating cylinder.

c. Remove attaching nuts and bolts that hold torque plate to axle flange, and slide assembly off of axle.

4-137. DISASSEMBLING BRAKE ASSEMBLY. It is not necessary to remove the brake assembly from the main landing gear to disassemble it. To disassemble the unit, proceed as follows:

a. With the airplane on jacks, remove main landing gear wheel.

b. Remove inboard wheel fairing.

c. Remove cotter keys and pins that attach links between operating cylinder and brake shoe.

d. Release all four adjusting bell cranks.

e. Remove cotter keys and pins that secure brake shoe to torque plate.

f. Remove cotter keys, and push connecting links from shoes.

g. Move brake shoe assembly toward bottom of torque plate, or away from operating cylinder, until shoe is clear of lower adjusting bell cranks.

h. Move brake shoe assembly toward top of torque plate, or toward operating cylinder, until shoe is clear of upper adjusting bell cranks.

i. Lift brake shoe assembly off torque plate.

j. Disconnect hydraulic line to operating cylinder. Remove attaching nuts, and lift cylinder from torque plate.

4-138. ASSEMBLING BRAKE ASSEMBLY. See figure 4-20.

4-139. INSTALLING BRAKE ASSEMBLY. See figure 4-20.

4-140. ADJUSTING BRAKE ASSEMBLY. See figure 4-20.

4-141. ENGINE MOUNTING.

4-142. The engine is attached to the airplane structure by means of rubber vibration cushions and a rigid engine mount. (See figure 4-21.) The rubber vibration cushions connect the engine to the rigid engine mount, which is bolted to the firewall at four places.

4-143. TROUBLE SHOOTING ENGINE MOUNTING.

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive roughness at idling or warm-up speeds.	Near resonant engine rpm, if under normal conditions.	Slight adjustment of operating speed to avoid resonance with natural frequency.
	Under extreme cold weather starting conditions, mountings may stiffen, raising natural frequency into critical range.	Engine heat will warm mountings and correct condition after initial start.

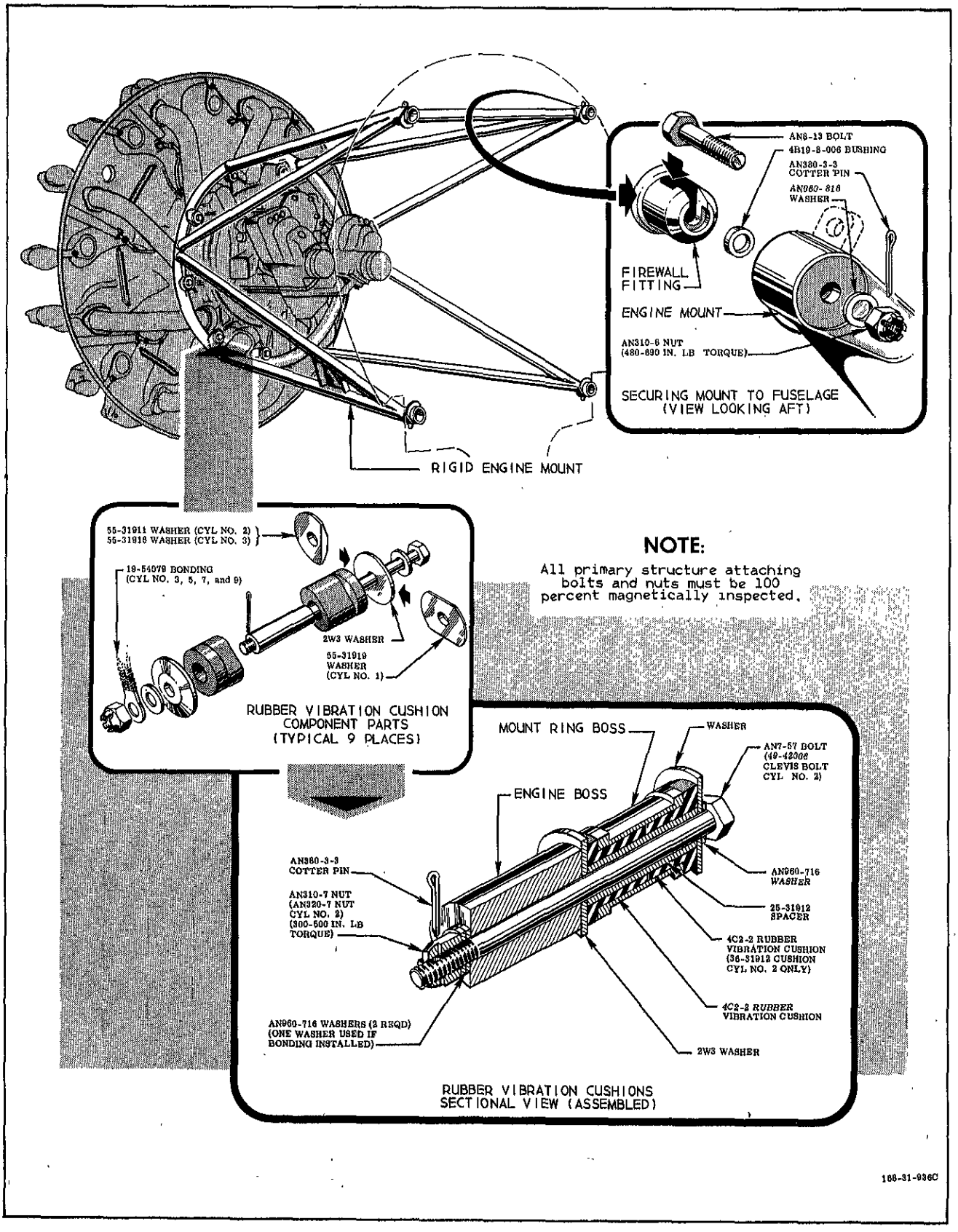


Figure 4-21. Engine Mount

TROUBLE	PROBABLE CAUSE	REMEDY
Excessive roughness at cruising engine speeds.	Excessive permanent set in rubber sections.	Remove and replace mounting.
	Failure of one rubber mounting or component metal part, causing improper operation of installation.	Remove and replace mounting

4-144. RUBBER VIBRATION CUSHIONS.

4-145. To provide directional support for the engine against vibration, nine rubber vibration cushions have been interposed between the engine and the rigid engine mount. (See figure 4-21.) Each rubber vibration cushion consists of a bolt, a rubber vibration absorber (made in two halves to facilitate assembly), two large washers, a spacer, a nut, small washers, and a cotter pin.

4-146. RIGID ENGINE MOUNT.

4-147. The rigid engine mount is composed of a ring and eight straight tubes. (See figure 4-21.) The eight tubes are welded to the ring at one end, and are joined together in pairs at the other end to form a "V." Attachment fittings have been welded to the joined ends of the tubes for attachment to the firewall. Nine mounting bosses have been incorporated in the ring for installation of the rubber vibration absorbers used to support the engine. The hydraulic hand-pump support bracket and engine fixed ring cowling support lugs have also been fabricated into the ring. A cross tube, secured by four bolts to the welded structure, supports the oil tank. Various items of equipment used in connection with the operation of the engine are also supported by the rigid engine mount. The engine-mount-to-firewall attachments incorporate hoisting provisions.

4-148. ENGINE COWLING.

4-149. The airplane engine cowling (figure 4-22), of semimonocoque construction, is composed of both permanently attached and readily removable cowl panels. The cowling installation consists of three removable engine nose ring cowling sections, six removable engine accessory cowling panels, an inner fixed engine ring cowling, and an inner fixed engine baffle.

4-150. ENGINE NOSE RING COWLING.

4-151. The engine nose ring cowling consists of three detachable sections that completely encircle the engine. These sections are supported around the engine by means of engine nose ring cowling supporting lugs bolted to the intake rocker box of each cylinder. Three engine ring cowling supporting pads incorporated in each nose ring cowling section rest in these lugs. A circular pad, mounted on the inside of each section of engine nose ring cowling, rests on the outer ring formed by the intercylinder baffles. This pad forms an air seal when the cowling is installed. Dzus-type fasteners secure these sections together, and latching provisions provide a means for drawing all three sections securely around the engine. The latching provisions consist of three bolt-type latches which have been incorporated on the left-hand side of the nose cowling. Access to two of these latches, located inside the leading edge of the cowling, is gained through the front of the engine ring cowling. The third latch is accessible on the outside of the cowling. The head end of the bolt-type latch is hinged and permanently attached. A trunnion on the threaded end of the latch fits into a trunnion cradle, and is drawn snug by a nut. A jam nut prevents the nut from turning. A cotter pin inserted through a hole in the threaded end of the latch prevents the two nuts and the trunnion from becoming lost when the cowling is removed.

CAUTION

Do not use excessive torque when tightening trunnion nuts, as permanent damage to cowling fasteners or cowling panels will result. To aid in seating the cowling support lugs in their supporting pads, the cowling should be jarred with the hands while the trunnion nuts are being turned.

4-152. ENGINE ACCESSORY COWLING.

4-153. The engine accessory cowling consists of a top panel, two upper side panels, two lower side panels, a bottom cowl section (oil cooler scoop), two upper cowl formers, and two lower cowl formers. The formers are bolted to the firewall and engine fixed ring cowling, while the top and two upper side cowl panels are dzus-fastened to the formers, fixed ring cowling, and the firewall. The bottom cowl section (oil cooler scoop) is bolted to the firewall and to the air mixing chamber. The lower side panels are dzus-fastened to the wing leading edge, cowl formers, bottom cowl, and the engine fixed ring cowling to fair the wing leading edge and main landing gear wheels as well as the engine accessory section. The two lower cowl formers are reinforced to support a man's weight, and may be used as a step. Incorporated in the cowling is the carburetor air scoop and screen assembly, as well as access doors for the oil filler cap and starter. On Airplanes AF49-2947 and subsequent, a spring-loaded door in the right-hand upper side panel is used for insertion of the fire extinguisher in case of fire, and as an emergency access to the battery disconnect.

4-154. FIXED INNER ENGINE COWLING.

4-155. The fixed inner engine cowling consists of the engine fixed ring cowling and the engine fixed baffle. The engine fixed ring cowling is a structural member that gives support to the removable accessory cowling, and is attached directly to the engine mount. The fixed engine baffle, located between the engine fixed ring cowling and the engine, is bolted to the engine, and prevents engine fumes and heat from escaping into the engine accessory section and cock pit.

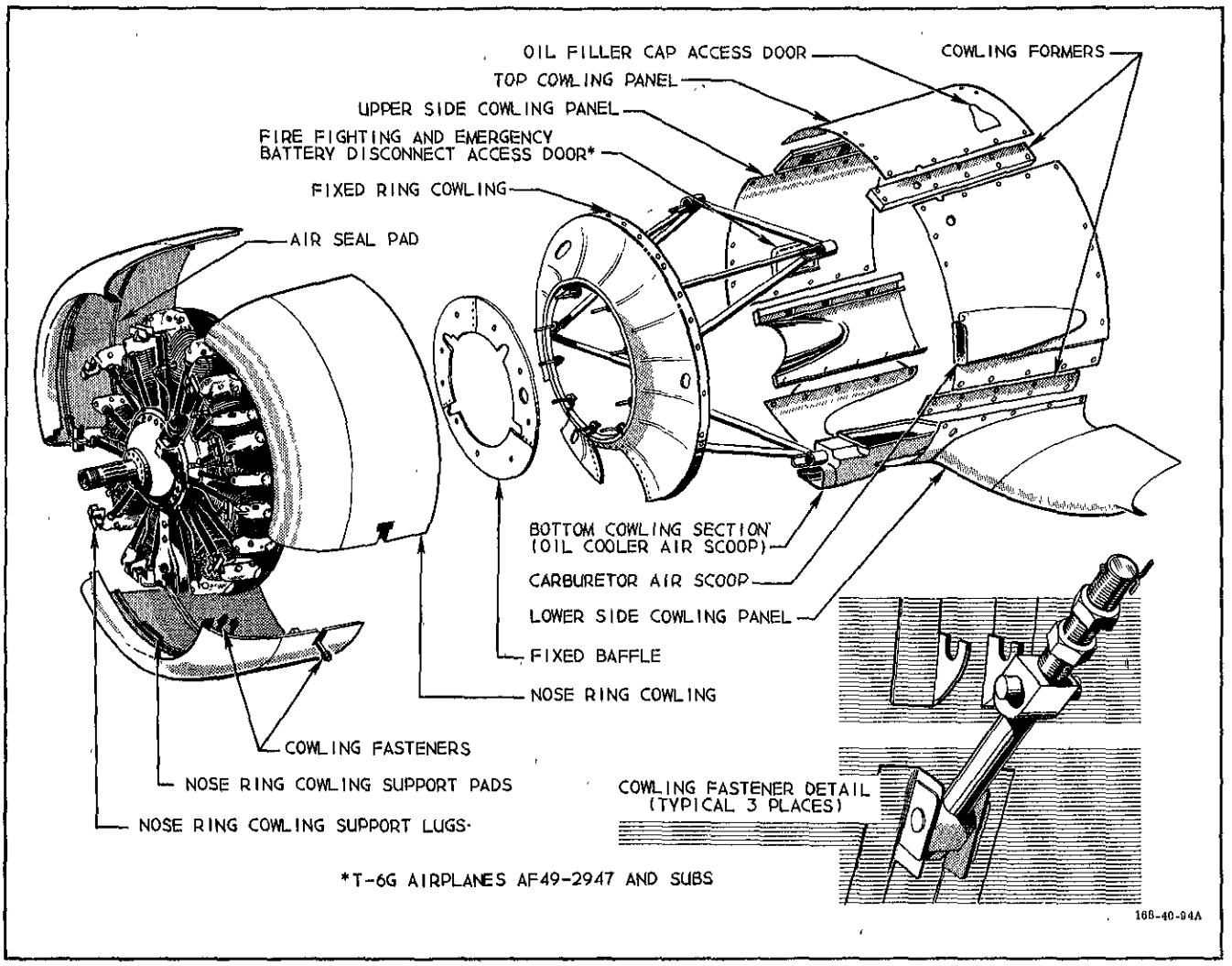


Figure 4-22. Engine Cowling

4-156. ENGINE.

4-157. The airplane is powered by a Pratt & Whitney, nine-cylinder, radial, air-cooled engine, Model No. R-1340-AN-1 (figure 4-23), which drives a two-blade Hamilton Standard, constant-speed, counterweight-type propeller. The engine has a piston displacement of 1344 cubic inches, and is equipped with a single-stage, high-speed, centrifugal-type supercharger impeller having a gear ratio of 10:1. Engine sea-level take-off power rating is 600 brake horsepower at 2250 rpm and 36 in. Hg manifold pressure for 5 minutes (maximum); normal rating at 5000 feet is 550 brake horsepower at 2200 rpm, with 32.5 in. Hg manifold pressure. The engine incorporates an SAE No. 40 single-rotation propeller shaft, rotating clockwise (as viewed from the rear of the engine), and a pressure-type, dry-sump lubricating system (paragraph 4-281). Engine components include a Y-type, Stromberg up-draft float-type carburetor (paragraph 4-202), and a high-tension ignition system (paragraph 4-269). Engine instruments include fuel and oil pressure, tachometer, cylinder head temperature, carburetor fuel-air mixture temperature, oil temperature, and manifold pressure indicators. Engine data is as follows:

No. cylinders	9
Bore	5-3/4 in.
Stroke	5-3/4 in.
Piston displacement	1344 cu in.
Compression ratio	6.03:1
Propeller spline shaft size	SAE No. 40
Propeller shaft reduction ratio	1:1
Supercharger impeller gear ratio	10:1
Crankshaft rotation (viewed from rear)	Clockwise
Valve timing	
Intake opens	26 degrees before top center

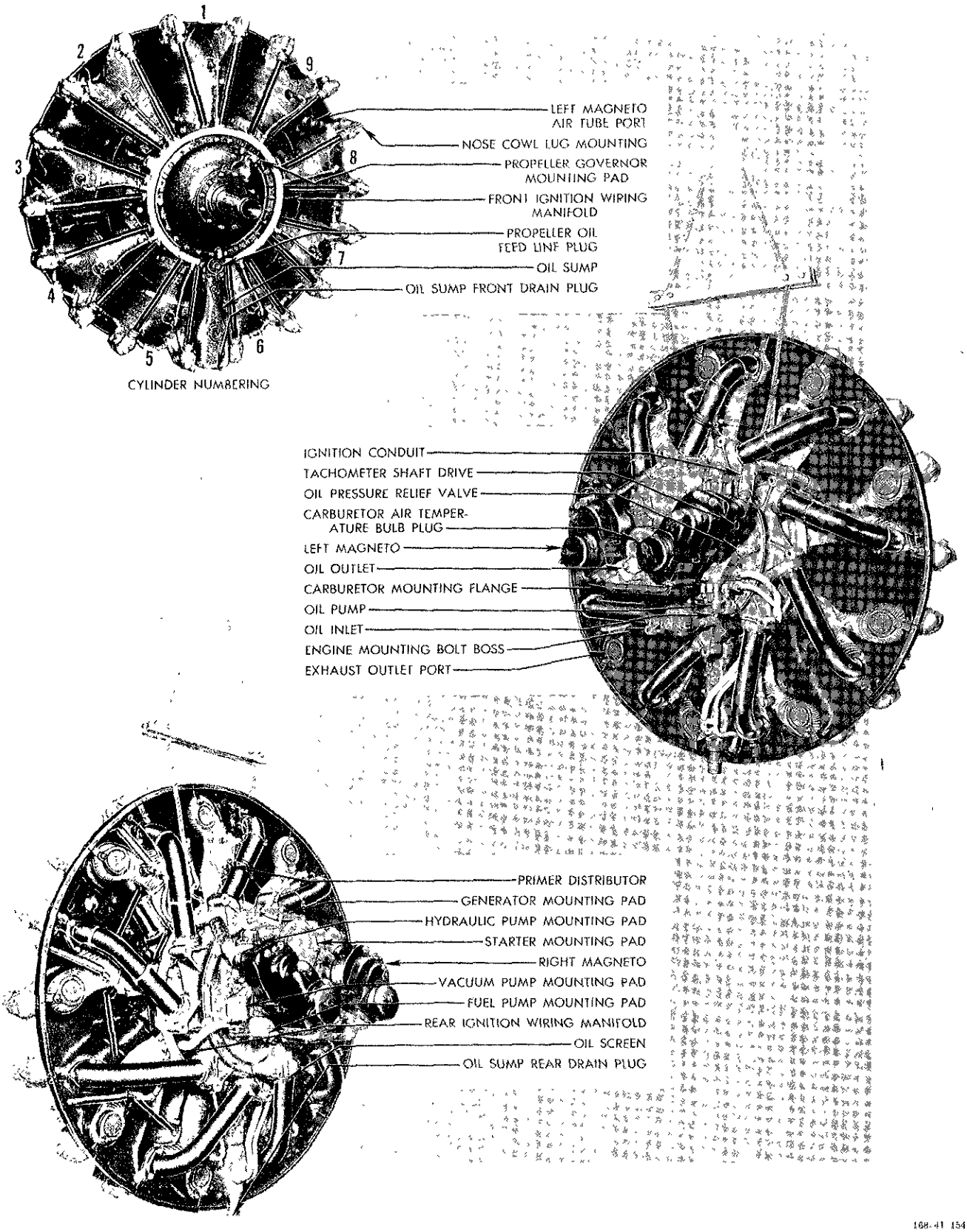


Figure 4-23. R-1340-AN-1 Engine

Intake closes	76 degrees after bottom center	Firing order	1, 3, 5, 7, 9, 2, 4, 6, 8
Exhaust opens	71 degrees before bottom center	Average dry weight of engine (less accessories, mount, and cowling)	Approx 875 pounds
Exhaust closes	31 degrees after top center		
Cold valve clearance	Timing .060 Adjusting .040	Power plant package weight (less cowl and propeller)	Approx 1100 pounds
Magneto timing	25 degrees before top center		

4-158. TROUBLE SHOOTING ENGINE.

TROUBLE	PROBABLE CAUSE	REMEDY
Engine fails to start or does not continue to run after starting.	Incorrect starting procedure.	Refer to Handbook of Flight Operating Instructions.
	No fuel in tanks.	Fill tanks with proper grade of fuel. Check fuel gage.
	Underpriming.	Increase number of priming strokes.
		Clean clogged priming lines and repair leaks in priming system.
	Primer inoperative.	Disconnect primer feed line from primer distributor, and operate primer. If fuel does not flow from feed line, repair or replace primer.
	Overpriming.	With ignition off, open throttle fully and rotate propeller shaft several times in direction of normal rotation. Decrease number of priming strokes.
	Insufficient fuel flow.	Check wobble pump. Repair or replace pump. Check fuel screens and lines. Clean clogged screens and lines.
	Insufficient cranking speed.	Check batteries and starter.
	Moisture or oil on distributors.	Clean distributor fingers and blocks with acetone, using a clean cloth. Wipe clean with a dry cloth.
	Booster inoperative.	Check booster operation. Install a new booster if necessary.
	Internal trouble with magnetos. CAUTION Do not use booster while making this check.	Turn engine over by starter, and check spark jump. A strong spark should jump when a wire from high-tension terminal is held 1/4 to 3/8 inch from a grounded surface. Replace magneto if there is no spark or if spark is weak.

TROUBLE	PROBABLE CAUSE	REMEDY
	Spark plugs wet, fouled, incorrect gaps, or cracked ceramic insulation.	Install serviceable plugs.
	Spark plug lead connectors oily, dirty, or cracked.	Clean dirty connectors with acetone. Replace damaged connectors.
	Burned spark plug leads.	Make continuity and high-voltage tests on harnesses. Replace wires, if necessary.
	Lead from a magneto ground connection to cockpit switch grounded.	Check wiring between ground connections and switch.
	Air leaks or restrictions in induction system.	Remove air scoop from carburetor. Check air screen for foreign matter. Make sure that air scoop is clear. Check security of carburetor on engine, and see that all intake pipe nuts are tight. Examine intake pipes to see that no primer lines are loose or disconnected.
	Restrictions in the exhaust manifold system.	Remove any obstructions in the system.
	Valves sticking or in need of adjustment.	Lubricate sticking valves. Adjust valve clearances. Replace cylinder, if necessary.
Rough running.	Loose or defective spark plugs.	Tighten loose plugs. Replace defective plugs.
	Improper operation of magnetos.	Check breaker points and magneto timing. Remove all dirt and moisture from distributor blocks and housings with acetone.
	Defective ignition wire.	Make continuity and high-voltage tests on harnesses. Replace defective ignition wiring.
	Mixture too rich:	
	Fuel pressure too high.	Adjust pressure relief valve on D3 fuel unit.
	Primer valve leaking.	Repair or replace valve.
	Carburetor control linkage not adjusted correctly.	Adjust linkage so that movement of cockpit controls results in corresponding correct movement of throttle and mixture control levers on carburetor.
	Mixture too lean:	
	Fuel pressure too low.	Check for clogged fuel lines or strainers. Check operation of wobble and engine fuel pumps, and make adjustments if necessary.

TROUBLE	PROBABLE CAUSE	REMEDY
	Air leaks in induction system.	Check all joints, connections, clamps, and nuts in the induction system for tightness.
	Fuel leaks.	Check all fuel line connections, joints, and clamps for tightness.
	Improper valve clearances.	Adjust valves.
	Sticking valves.	Lubricate valve stems. If necessary, replace cylinder.
	Propeller loose.	Tighten.
	Propeller not tracking evenly.	Install a propeller which tracks evenly.
	Propeller out of balance.	Install a propeller which is in balance.
	Excessive propeller shaft runout.	Check and replace engine if necessary.
	Loose engine mounting bolts.	Check all bolts to see that they are tightened to proper torque.
	Loose air ducts.	Thoroughly examine all air duct connections and supports. Tighten where necessary.
	Loose exhaust collector ring.	Check the ring, and tighten any loose nuts.
	Loose cowling supports.	Check all cowling supports, and make sure they are securely fastened.
	Fuel pressure loss or fluctuation.	Check fuel pump and connections. Replace pump, if necessary.
Engine misfiring.	Defective spark plugs, ignition harnesses, or magnetos.	Check magneto operation and spark plugs. Make continuity and high-voltage tests on the ignition harnesses.
	Excessively lean or rich mixtures.	Check mixture control setting and control linkage to the carburetor.
	Valves sticking, or improper valve clearances.	Check valve clearances and valve operation.
	Broken valve springs.	Lubricate valve stems; replace broken springs.
	Air leaks in the induction system.	Check intake pipes for cracks or leaks at the packing nuts. Check carburetor gasket for leaks.
	Improper use of carburetor heat control.	Check instructions for use of carburetor heat control.
	Internal trouble with carburetor.	Install a new carburetor.

TROUBLE	PROBABLE CAUSE	REMEDY
	Carburetor control linkage in need of adjustment.	Readjust linkages so that there is no excess play, and movement of cockpit control results in a full, free movement of lever arms on carburetor.
	Magnetos incorrectly timed to engine.	Time magnetos to engine.
Engine does not idle, or idles improperly.	Cold engine.	Warm up engine thoroughly before permitting it to idle.
	Incorrect carburetor idle adjustment.	Adjust carburetor idle mixture and speed.
	Carburetor not functioning properly.	Replace carburetor with one known to be operating correctly.
	Defective spark plugs or ignition wires.	Locate defective plugs by magneto check and replace with serviceable plugs.
		Make continuity and high-voltage tests on ignition harnesses.
Engine exhaust smoking.	Mixture too rich:	
	High fuel pressure.	Adjust fuel pressure valve.
	Primer valve leaking.	Repair or replace valve.
	Carburetor control linkage not adjusted properly.	Adjust linkage so that movement of cockpit controls results in corresponding correct movement of throttle and mixture control levers on carburetor.
Oil foaming from breathers or oil tank vent.	Water or impurities in the oil.	Drain engine and tank. Refill with new oil.
	Oil splashing into tank from incorrectly installed oil return line.	Install oil return line correctly.
	Oil tank filled too full.	Drain a sufficient amount of oil from tank.
	Excessive oil dilution.	Check oil dilution valve for leaks.
	Clogged oil tank vent lines.	Clean lines.
	Clogged oil feed and return lines.	Clean lines.
Low power.	Faulty ignition.	Check ignition system operation.
	Carburetor not functioning properly.	Check and adjust control linkages. Replace carburetor, if necessary.
	Faulty operation or improper setting of propeller governor.	Adjust or replace governor.

TROUBLE	PROBABLE CAUSE	REMEDY
	Incorrect propeller blade pitch setting.	Reset blade angles.
	Wrong grade of fuel.	Fill tanks with approved fuel.
	Carburetor air heater mixing chamber not functioning properly.	Adjust controls. Repair or replace chamber.
	Restrictions in the induction system.	Check air scoop for obstructions. Clean air screen.
	Valves sticking, leaking, or improper clearances. Broken valve springs.	Check valve clearances and valve operation. Lubricate sticking valves, and replace broken springs.
	Loose spark plugs.	Tighten loose plugs.
Low oil pressure.	Defective oil pressure gage.	Repair or replace gage.
	Congealed oil in pressure gage line.	Disconnect line and clean out congealed oil.
	Incorrect grade or insufficient quantity of oil.	Check oil supply.
	Defective oil dilution valve.	Repair or replace valve.
	Oil screen clogged.	Remove and clean oil screen. If metal particles are found in the screen, check cause.
	Oil pressure relief valve not functioning properly.	Remove, clean, and inspect relief valve. When a relief valve has once been set correctly for the engine, do not readjust to remedy variations in oil pressure.
	Obstructions or leaks in the oil lines.	Check for and remove any obstructions. Repair any leaks.
High oil pressure.	Defective oil pressure gage.	Repair or replace gage.
	Low oil inlet temperature.	Check oil cooler thermostat.
Low oil temperature.	Oil temperature gage not functioning properly.	Repair or replace gage.
High oil temperature.	Obstruction of airflow through oil cooler.	Remove obstruction or replace cooler.
	Oil cooler pipes clogged.	Clean or replace cooler.
	Automatic oil temperature control unit not operating correctly.	Repair or replace control unit.
	Improper oil scavenging.	Check oil scavenge lines for leaks and obstructions.
	Diluted or contaminated oil.	Drain engine, lines, cooler, and tanks. Fill with new oil.

TROUBLE	PROBABLE CAUSE	REMEDY
Engine does not accelerate properly.	Accelerating pump not operating properly.	Replace pump.
	Wrong grade of fuel.	Use proper grade of fuel.
	Valves sticking, leaking, or improper clearances.	Check valve clearances and valve operation.
		Lubricate valve stems. Replace cylinder, if necessary.

4-159. REMOVING ENGINE.

4-160. The entire power plant package (from the firewall forward) may be readily removed as a unit, or the engine proper may be removed from the engine mount, leaving the engine mount, oil tank, fixed cowl, etc, attached to the airplane. If a complete replacement power plant package is available, it is recommended, as a matter of expediency, that the entire power plant package be removed as a unit from the firewall. If a complete replacement power plant package is not available, it may be more expedient to remove the engine at the engine mount. To remove the entire power plant package as a unit, refer to paragraph 4-161. To remove engine from mount, refer to paragraph 4-162.

4-161. REMOVING POWER PLANT PACKAGE FROM FIREWALL. To remove power plant package as a unit, proceed as follows:

a. Make sure ignition switch is "OFF"; then remove propeller. (Refer to paragraph 4-242.)

b. Remove engine nose ring cowl and dzus-fastened engine accessory section cowl panels.

c. Remove oil cooler scoop.

d. If engine is to be replaced, drain oil system. (Refer to paragraph 3-29.) It is not necessary to drain the oil system if the power plant package is to be left intact and is to be reinstalled.

e. Turn fuel selector valve to "OFF."

NOTE

It is not necessary to drain the fuel system after positioning fuel selector valve to "OFF," or to drain the hydraulic system.

f. Attach quick-change sling (E3) to propeller shaft and to hoist lugs on rear of engine mount upper legs. (See figure 4-24.) Relieve power plant package weight (approximately 1100 pounds) from airplane.

g. Disconnect engine-to-firewall connections listed and shown in figure 4-24.

h. Disconnect cowl formers at the firewall.

i. Check to make sure all connections have been disconnected, and that all lines, conduits, hoses, and rods are clear; then remove cotter pins and the four engine mount nuts at the firewall. Lower the engine slightly until top legs of engine mount disengage from the firewall top fittings. Remove top firewall fitting spacers and bolts, and place a block of wood between top legs of mount and the firewall fittings; then slowly lift engine until lower engine mount fittings are disengaged. Move power plant forward until clear of firewall. Mount power plant package on a suitable stand.

4-162. REMOVING ENGINE FROM ENGINE MOUNT. To remove engine from mount, proceed as follows:

a. Make sure ignition switch is "OFF"; then remove propeller. (Refer to paragraph 4-242.)

b. Remove engine nose ring cowl and dzus-fastened engine accessory section cowl panels.

c. Remove oil cooler scoop.

d. Drain oil system. (Refer to paragraph 3-29.)

e. Turn fuel selector valve to "OFF."

f. Remove outer heat muffs from fixed-ring cowl.

g. Disconnect and remove starter handcrank extension shaft at starter.

h. Disconnect starter hand engaging cable at starter.

i. Disconnect all electrical wiring and conduit from the respective engine units.

j. Disconnect oil pressure line at engine.

k. Disconnect manifold pressure line at top of engine.

l. Disconnect primer line at primer distributor unit on engine.

m. Disconnect hydraulic lines at hydraulic pump; then remove hydraulic pump.

n. Disconnect throttle and mixture control rods at carburetor and carburetor air control rod at air mixing chamber. Disconnect and remove propeller governor control rod between governor and intermediate bell crank on engine mount.

o. Disconnect heat and vent air duct at heat muff on upper right side of exhaust collector ring.

p. Disconnect and remove magneto air blast tubes.

q. Remove generator.

r. Remove vacuum pump and connecting lines.

s. Remove carburetor air duct, air mixing chamber adapter, and carburetor.

t. Make certain that all lines, conduits, hoses, and rods are disconnected and clear; then remove air deflectors between the top three cylinders. Attach engine hoist sling (E-10) to engine lifting eyes located behind No. 1 cylinder, and relieve engine weight from mount. Engine weight is approximately 875 pounds.

u. Remove the nine engine-to-mount attachment bolts. Remove bottom bolts first, and progress around both sides so that top bolts are removed last.

CAUTION

Two men are required to remove the engine: one to manipulate the hoist, and one to remove the attaching bolts.

v. After all bolts are removed, carefully move engine forward, guiding the engine until it is clear of the mount ring to prevent damage.

w. Remove all engine accessories and adapting parts from the engine for installation on replacement engine.

4-163. INSTALLING ENGINE.

4-164. The entire power plant, including all units forward of the firewall without removable cowling, may be installed on the airplane as a complete package unit; or the engine may be installed on the engine mount with the mount, oil tank, oil cooler, engine fixed cowl diaphragm, etc, installed on the airplane. The sequence of operations required for both methods of engine installation is outlined in paragraphs 4-165 and 4-166. All connections are conveniently located and easily connected. Engine lifting eyes are provided between the top three cylinders; hoisting lugs are located on the firewall attachment end of the upper two legs of the engine mount.

4-165. INSTALLING POWER PLANT PACKAGE ON FIREWALL. To install power plant package, proceed as follows:

a. Build up power plant package by installing engine mount, accessories, fixed cowling, etc, on the engine.

b. Attach quick-change sling (E3) to propeller shaft and hoist lugs on rear of engine mount upper legs. (See figure 4-24.)

c. Install the four spacers and bolts in firewall fittings; then apply a thin coating of antiseize compound (Specification No. JAN-A-669) to the attaching bolts and fittings.

d. Raise and move power plant unit aft onto firewall, engaging first the two upper firewall fittings, and then the two lower fittings. Secure each engine mount leg fitting to the firewall fitting bolts. (See figure 4-24.) Remove hoist sling.

e. Connect all remaining engine-to-airplane connections as shown in figure 4-24.

f. After all connections are made, inspect all lines for proper clearance and alignment, hose clamps for proper tightness and spacing, and all items for security and safety. Clean entire assembly of dirt, tape, safety wire, and other foreign material.

g. Install propeller. (Refer to paragraph 4-244.)

h. Adjust engine controls. (Refer to paragraph 4-221.)

i. Install cowling.

4-166. INSTALLING ENGINE IN ENGINE MOUNT. To install engine in engine mount, proceed as follows:

a. Install air seal baffle on engine rear case.

b. Install rubber vibration cushion (36-31912) in rear of upper right engine mount lug (as viewed from rear). Install two rubber vibration cushions (4C2-2) in each of the remaining eight engine mount lugs, and one cushion (4C2-2) into the front of the upper right lug. (See figure 4-21.)

NOTE

If 36-31912 cushion is not available, install 4C2-2 cushion; then cut off a portion of cushion to provide clearance between cushion and generator when engine is installed.

c. Install washer (AN960-716) on eight bolts (AN7-57) and one special clevis bolt (49-42006).

NOTE

If special 49-42006 clevis bolt is not available, an AN7-57 bolt may be substituted.

d. Install special washer (55-31919) and special spacer (25-31912) on one of the bolts (AN7-57); then insert assembly through rear of cushions in upper left engine mount lug.

e. Install special washer (55-31911) and special spacer (25-31912) on special clevis bolt (49-42006); then insert assembly through rear of cushions in upper right engine mount lug.

f. Install special washer (55-31916) and special spacer (25-31912) on one bolt (AN7-57), and insert assembly through rear of cushions in mount lug between cylinders No. 2 and 3.

g. Install washer (2W3) and special spacer (25-31912) on the remaining six bolts (AN7-57); then insert

assemblies through rear of cushions in the remaining engine mount lugs.

h. Install washer (2W3) on each of the nine bolts protruding through rubber cushions.

i. Remove the intercylinder baffles between cylinders No. 1 and No. 9 and between cylinders No. 1 and No. 2; then attach engine hoist sling (E-10) to engine lugs between cylinders.

j. Raise engine to align with engine mount ring; then carefully guide engine through mount ring, and insert bolts in engine mounting bosses.

k. Attach bonding braid on bolts at cylinders No. 9, 3, 5 and 7; then while holding bolt heads, secure bolts with washers (AN960-716) and nuts (eight, AN310-7; one, AN320-7). Torque bolts to 300-500 inch-pounds, and safety nuts.

CAUTION

Torque bolts evenly to obtain maximum vibration absorbing characteristics and to ensure proper engine-to-mount alignment.

l. Safety special washers (55-31919, 55-31911, and 55-31916) to engine mount to prevent turning due to vibration.

m. Remove engine hoist sling, and install intercylinder baffles.

n. Install carburetor and adapter duct on engine.

o. Install engine fixed cowl (if not installed).

p. Install carburetor air mixing chamber; then connect oil cooler support straps to air mixing chamber.

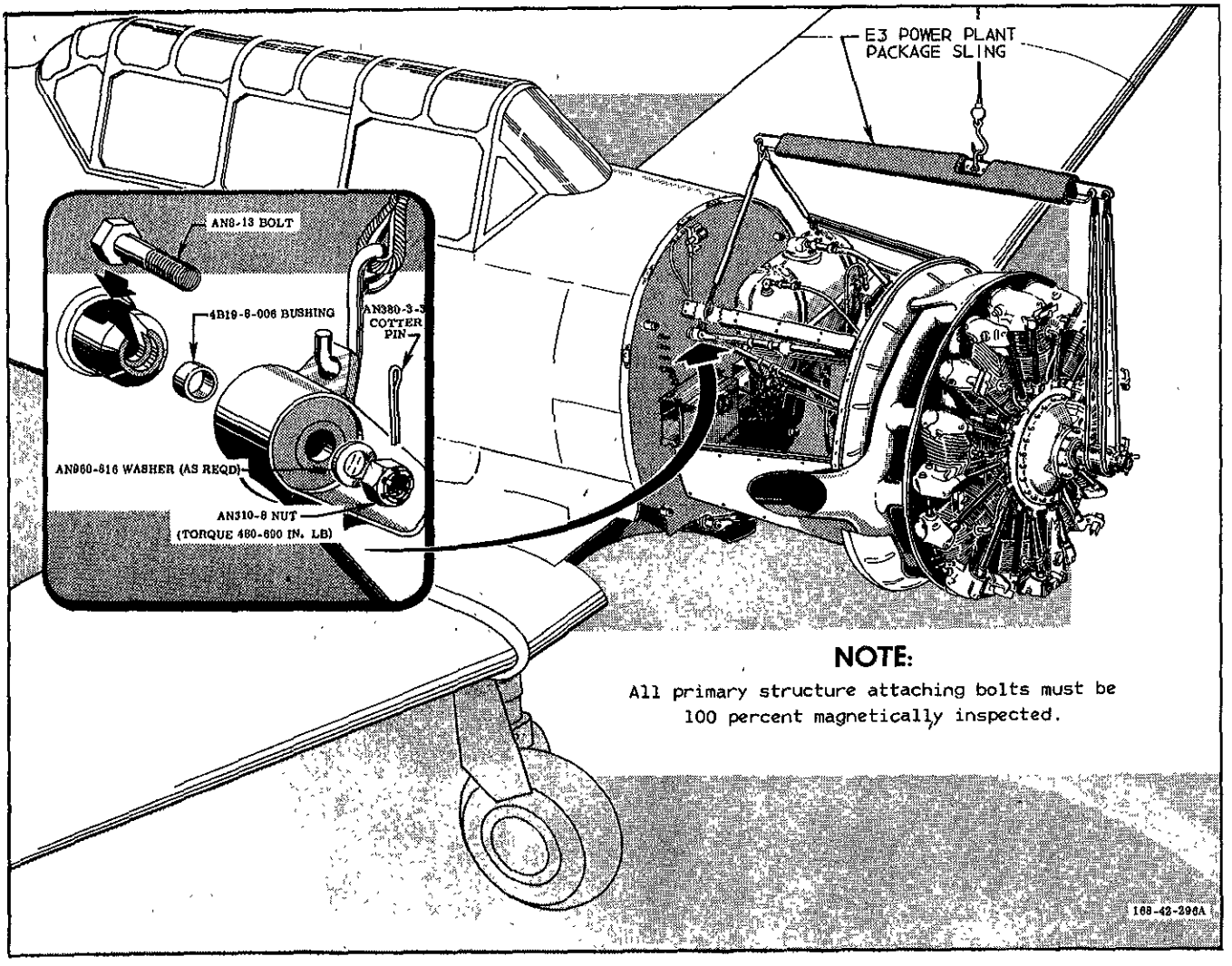
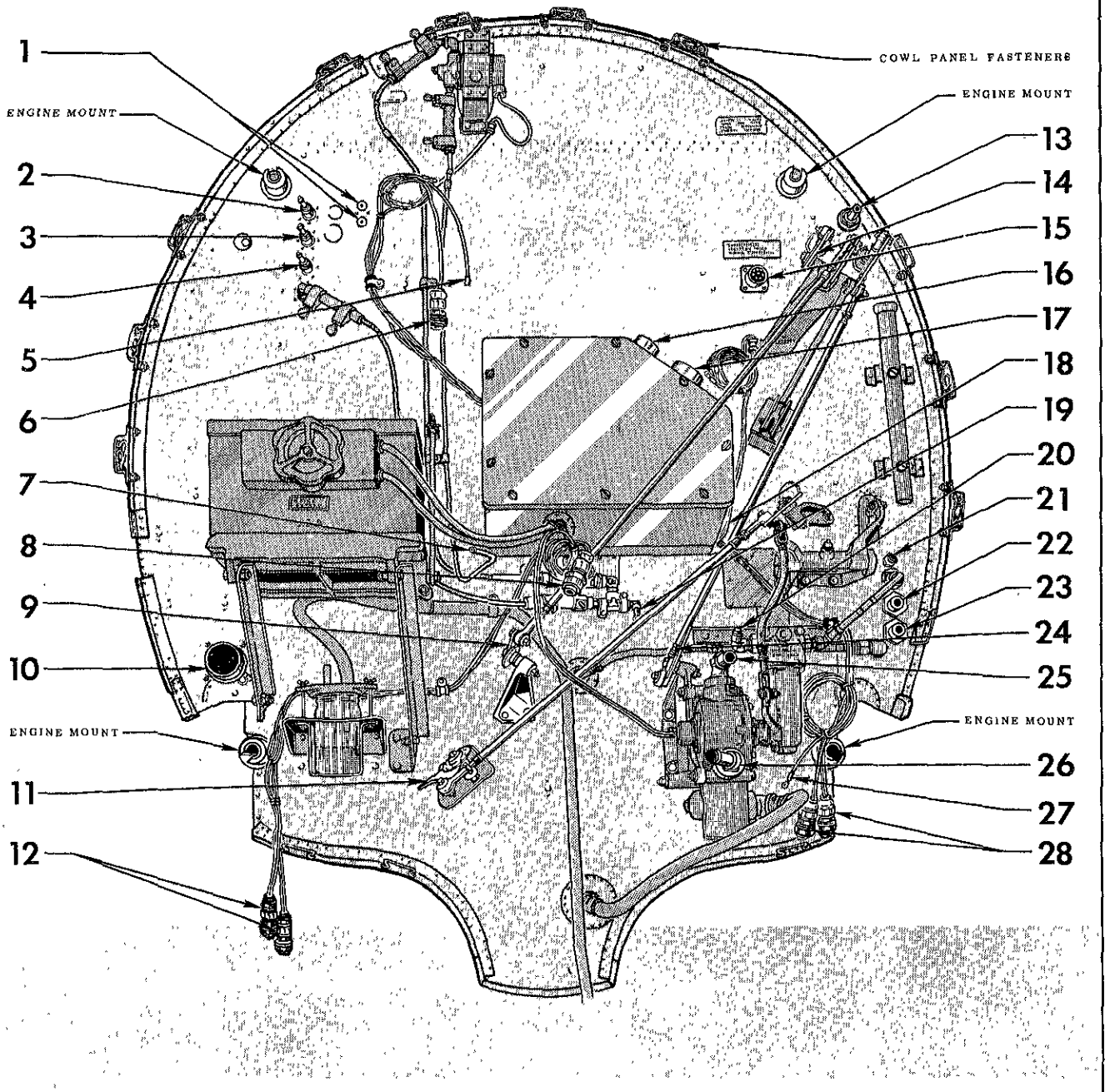


Figure 4-24 (Sheet 1 of 3 Sheets) Installing Power Plant Package



1 CYLINDER HEAD TEMPERATURE
2 MANIFOLD PRESSURE
3 PRIMER
4 OIL PRESSURE
5 IGNITION INDUCTION
6 TACHOMETER
7 OIL DILUTION FUEL
8 CARBURETOR MIXTURE TEMPERATURE
9 MIXTURE CONTROL
10 COCKPIT HEATED AIR
11 CARBURETOR AIR CONTROL
12 OIL TEMPERATURE
13 VACUUM
14 PROPELLER CONTROL

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Figure 4-24 (Sheet 2 of 3 Sheets). Installing Power Plant Package

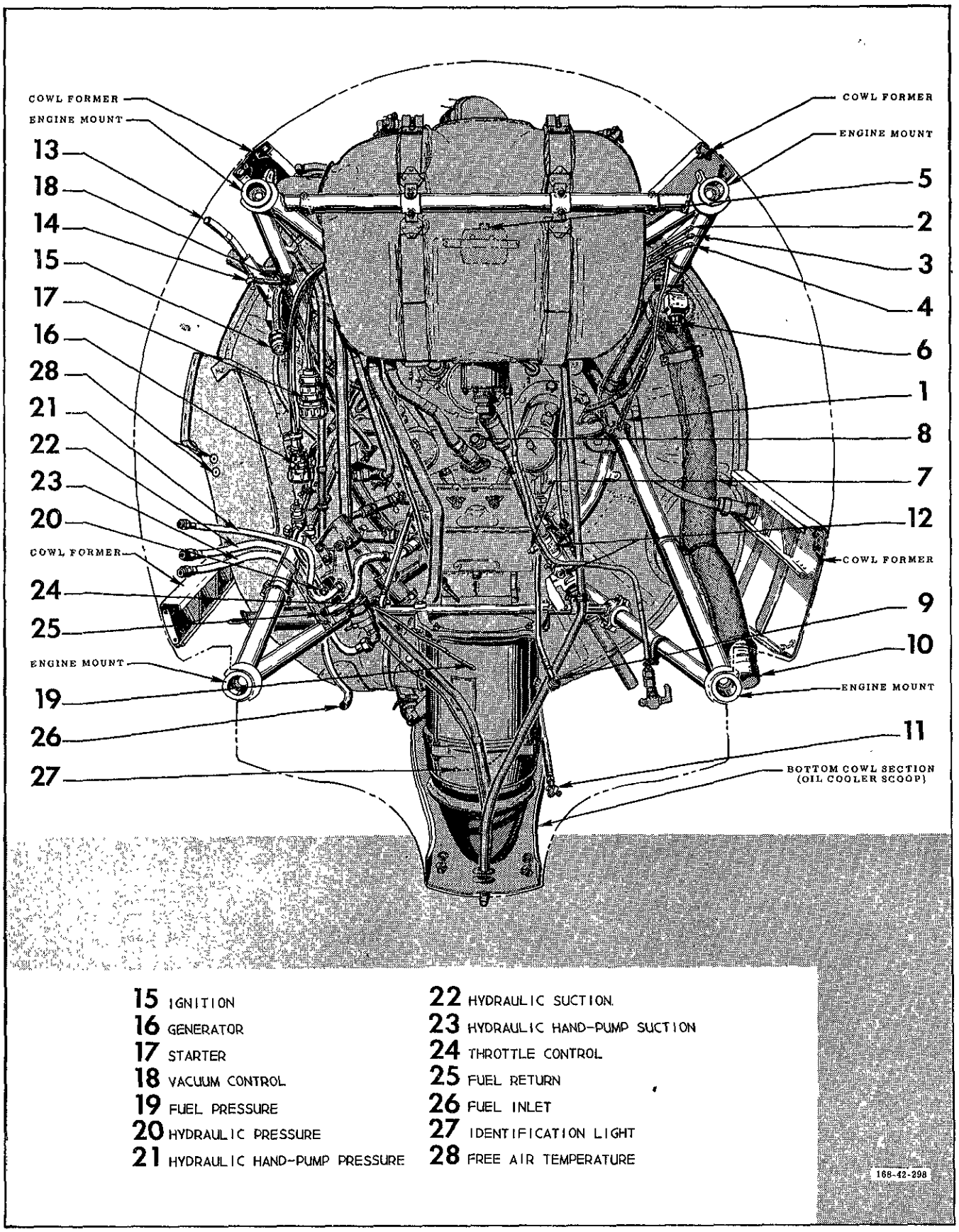


Figure 4-24 (Sheet 3 of 3 Sheets). Installing Power Plant Package

q. Install generator, hydraulic pump, and vacuum pump.

r. Insert each magneto air blast tube through fiber fairleads in engine fixed baffle assembly; then secure each tube end to its respective air scoop. Adjust tube leather chafing collar so as to protect tubes at fairleads.

s. Connect the lines, conduit, hoses, and rods as follows:

- Fuel feed line at outboard side of fuel pump and to "T" fitting at left rear corner of carburetor.
- Fuel pump drain line to rear of pump flange.
- Primer line to fuel outlet distributor at top of engine.
- Hand-pump line to left rear corner fitting of carburetor.
- Hand-pump line to inboard side fitting of fuel pump.
- Engine breather line at top of engine crankcase.
- Oil inlet hose at fitting below oil pump.
- Oil outlet hose to fitting at center of engine rear case.
- Tank vent lines to fittings at left and right rear of engine rear case.
- Hydraulic pressure hose to inboard port fitting of hydraulic pump.
- Hydraulic suction hose to outboard port fitting of hydraulic pump.
- Oil pressure line to upper left rear side of engine rear case.
- Manifold pressure line to elbow fitting above crankcase and aft of cylinder No. 1.
- Vacuum discharge line to lower port fitting of vacuum pump.
- Vacuum suction line to upper port fitting of vacuum pump.
- Oil separator drain line to right oil tank vent "T" fitting.
- Thermocouple leads to rear of cylinder No. 5.
- Ignition lead to left magneto.
- Booster lead to right magneto center plug.
- Starter plug to left side receptacle of power control box on firewall.
- Tachometer flexible shaft to gear drive on right side of engine rear case.
- Carburetor fuel-air temperature lead to bulb above carburetor.
- Throttle, mixture, carburetor air, and propeller governor control rods to their respective units. Adjust controls. (Refer to paragraph 4-221.)

t. Install engine cowling.

4-167. ADJUSTING VALVE CLEARANCES.

4-168. The valve clearances are adjusted when the engine is cool in a sequence which conforms to the firing order of the cylinders: 1, 3, 5, 7, 9, 2, 4, 6, 8.

a. Remove the rocker box covers and the front spark plug from each cylinder.

b. Turn the crankshaft counterclockwise (normal direction of rotation viewed from front of engine) until the piston of the required cylinder (see following table) is at the exact top dead center of its exhaust stroke. Back off valve adjusting screws to ensure sufficient clearance.

SET PISTON AT TOP CENTER OF EXHAUST STROKE	ADJUST VALVE CLEARANCE TO .040 INCH	
	Inlet Valve	Exhaust Valve
1	5	6
3	7	8
5	9	1
7	2	3
9	4	5
2	6	7
4	8	9
6	1	2
8	3	4

c. Insert a .040-inch feeler gage (PWA-672) between the adjusting screw insert and the No. 5 inlet valve stem; then turn down adjusting screw until slight drag is felt on feeler. Tighten the locknut to 300-350 inch-pounds, using wrench (PWA-2835). Adjust No. 6 exhaust valve to same clearance in the same manner. Make all other valve clearance adjustments in same manner, in the order they are listed in table.

d. Install rocker box covers, gaskets, and spark plugs. Replace rocker box covers that are in poor condition; otherwise, serious oil leakage will result. Tighten rocker box cover nuts to a torque of 70 to 82 inch-pounds.

4-168A. CYLINDER COMPRESSION TEST. (See figure 4-24A.) Using aircraft engine cylinder compression tester assembly, Type S-1, Part Number 47R11992, and a 0.040-inch orifice bleeding into the cylinder, check the cylinder compression as follows:

a. To obtain consistent readings, it is advisable to perform the compression as soon as possible after the engine has been shut down. This is desired in

order that all piston rings, etc, will be uniformly lubricated. It will not be necessary to operate the engine prior to accomplishing the compression checks during engine build-up or on individually replaced cylinders. However, in such cases, a small quantity of lubricating oil will be sprayed in the cylinders and the engine turned over a few times to seal the piston rings, etc, prior to accomplishing the compression check.

b. Take standard precautions against accidental firing of the engine.

c. Remove necessary cowling.

d. Remove the most accessible spark plug from each cylinder.

e. Install the spark plug connector and seal ring in the No. 1 cylinder (figure 4-24B). Tighten the spark plug connector sufficiently to assure a seal.

f. Connect the compression tester assembly to the compressed air supply. With the check valve closed, adjust the main line pressure from the compressor to 80 psi on the regulated pressure gage.

g. Open the check valve and attach the air hose quick-connect fitting to the spark plug connector. This will establish a pressure of 15 psi in the cylinder when both intake and exhaust valves are closed, provided the cylinder will hold 15 pounds when checked as outlined in step 10.

h. Turn the engine over in the direction of rotation by hand until the piston in the No. 1 cylinder is coming up on compression stroke against the 15 psi and continue turning slowly until the piston reaches top dead center. Reaching top dead center is indicated by a flat spot or sudden decrease in force required to turn the propeller. If the engine is rotated too far, back up at least 1/2 revolution and start over again to eliminate the effect of backlash in the valve operating mechanism and to keep the piston ring seated on the lower ring lands.

i. Close the shutoff valve. Check the regulated pressure and adjust, if necessary to 80 psi.

CAUTION

Care must be exercised in closing the shutoff valve, for if the piston is not at top dead center, there will be sufficient air pressure build-up in the cylinder to rotate the propeller approximately 1/4 turn.

j. With the regulated pressure adjusted to 80 psi, if the cylinder pressure reading as indicated on the cylinder pressure gage is below the minimum of 35 psi, move the propeller in the direction of rotation to seat the piston rings in the grooves. If the pressure does not build up, go on to the next cylinder. When all cylinders have been checked and readings recorded, return to the cylinder or cylinders having low compression readings.

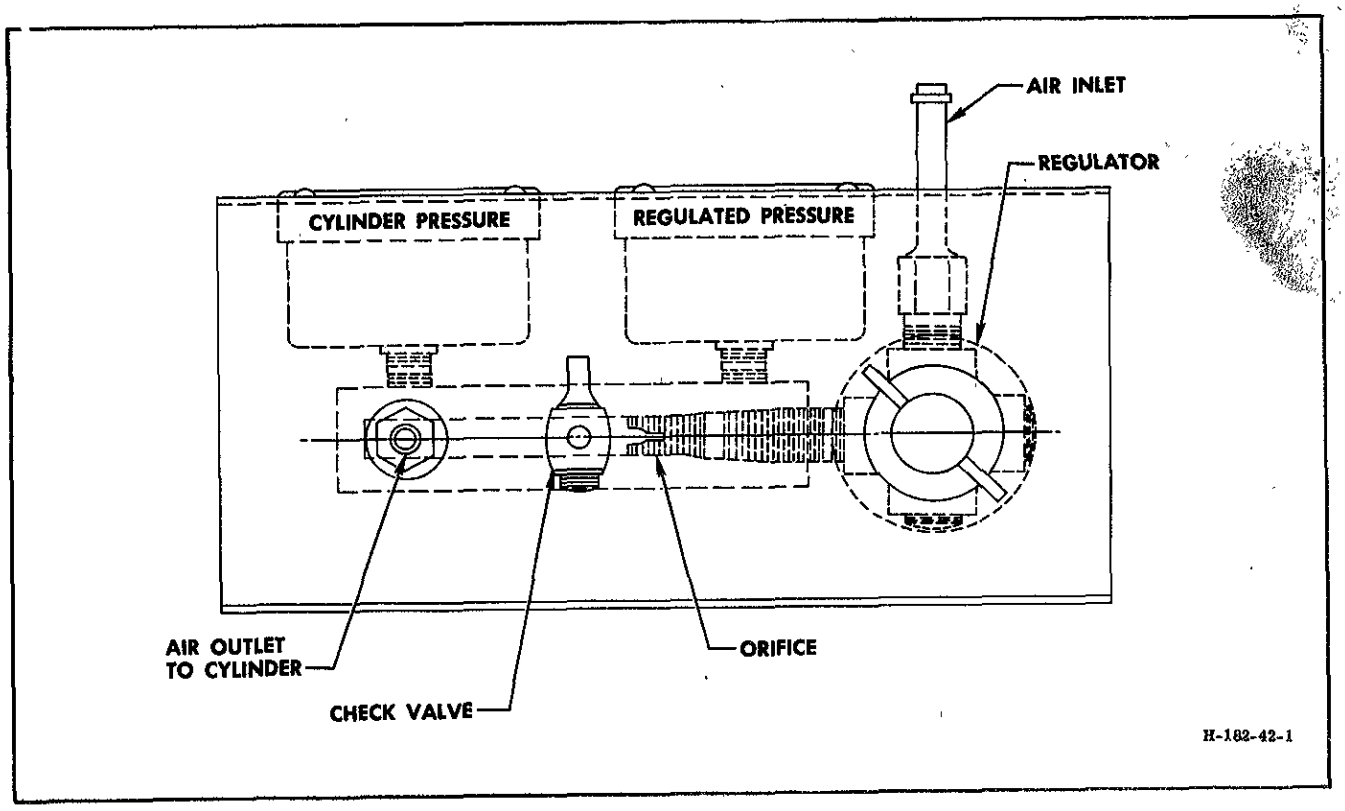


Figure 4-24A. Compression Testing the Cylinder

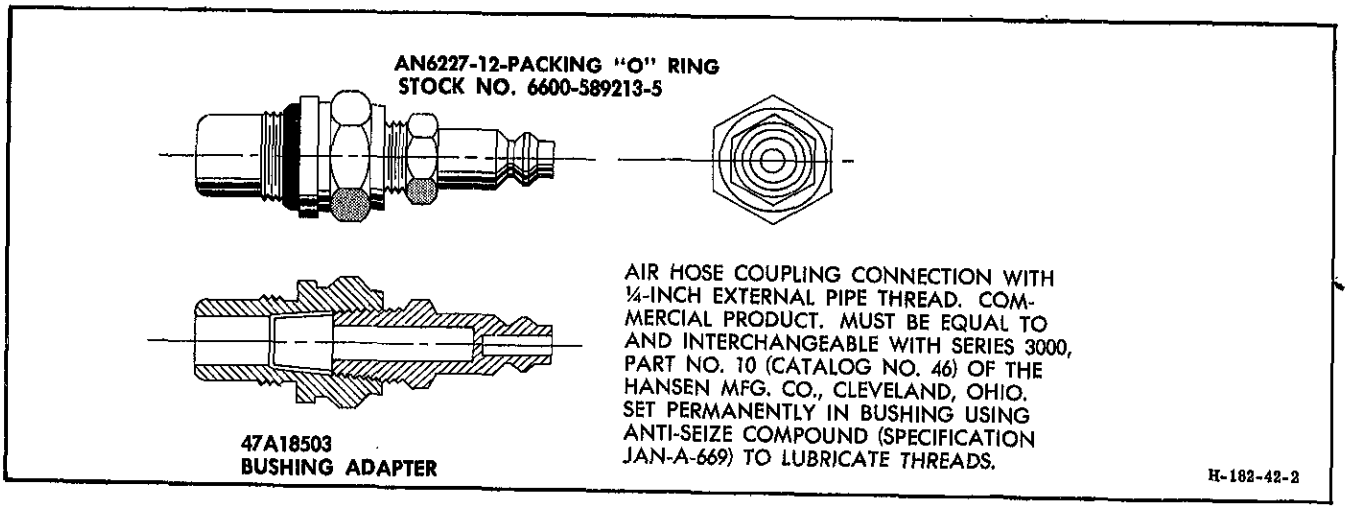


Figure 4-24B. Connector Assembly, Cylinder Compression Tester

k. When the compression is obtained on cylinders, the engine will be turned through with the starter or restarted and run to take-off power and the cylinder or cylinders having low compression rechecked. If this does not correct the difficulty, the rocker box cover will be removed and the valve clearance checked to determine if the low compression is due to negative valve clearance. If the difficulty is not caused by negative valve clearance, place a fiber drift on the rocker arm immediately over the valve stem and tap the drift several times with a one to two pound hammer. Then rotate the engine with the starter and recheck the compression.

NOTE

Compression checks will not be made after staking a valve until the crankshaft has been rotated either with the starter or by hand to reseat the valve in a normal manner as the higher seating velocity obtained when staking the valve will indicate valve seating, even though the valve seats are slightly egged or eccentric.

l. Cylinders having compression below the minimum 35 psi after accomplishing the foregoing action will be further checked to determine whether leakage is past exhaust valve, intake valve, or piston. Excessive leakage past the piston is the second most frequent cause of compression leakage and can be detected on cylinders approaching the horizontal position by squirting engine oil around the piston and rechecking the compression. If this action raises the compression to, or above, the minimum required, the cylinders may be continued in service. Results of the above tests will be entered on a compression sheet.

m. Repeat procedure outlined in steps a. through i.

n. Engines with more than three cylinders having less than the specified minimum compression value of 35 psi will be given a flight test followed by a recheck of the cylinders having low compression. If more than three cylinders still retain less than the specified 35 psi minimum compression value after the flight test, the engine will be replaced.

4-169. PREOILING ENGINE.

4-170. Prior to initial start of a new or overhauled engine, the engine must be preoiled as follows:

a. Place ignition switch in "OFF" and mixture control in "IDLE CUT-OFF."

b. Fill oil tank with corrosion-preventive mixture (Specification No. AN-VV-C-576, Type II).

c. Disconnect oil inlet line at oil pump inlet fitting, and drain sufficient oil to ensure that inlet line is free of obstructions and air; then connect and tighten line.

d. Remove front spark plug from each cylinder and engine main sump plug.

e. Connect external power source to airplane.

f. Remove 1/4-inch plug from oil pump body.

g. Connect preoiling pump to 1/4-inch pipe hole; then, while motoring engine with starter, pump corrosion-preventive mixture into engine until mixture flows from sump plug hole.

CAUTION

Do not operate starter for more than 30 seconds continuous direct cranking. Allow one minute cooling before starter is operated again following each 30-second cranking interval.

h. Disconnect preoiling pump, and install plug. Install and safety sump plug.

i. Install spark plugs. (Refer to paragraph 4-279.)

j. Start engine as soon as practicable (maximum 3 hours) after completing the foregoing preoiling procedure.

4-171. PREOPERATIONAL TEST OF POWER PLANT PACKAGE AFTER INSTALLATION.

4-172. After installation of a new or overhauled engine, and before an attempt at operation, the power plant package and related systems must be inspected and tested to determine that the installation is proper and safely operable. The following test may be accomplished with accessory cowling removed.

a. Remove, clean, and reinstall engine main oil screen assembly.

b. Fill fuel and hydraulic systems as required. (Refer to paragraphs 3-24 and 3-32.)

c. Preoil engine. (Refer to paragraph 4-170.)

d. Ensure that magneto ground wires are properly connected, and inspect all ignition wiring for security.

e. Inspect all engine mounting bolts for proper tightness and safety.

f. Inspect propeller for tightness, safety, and proper lubrication.

g. Drain all fuel system water traps.

h. Prepare carburetor for service. (Refer to paragraph 4-206.)

i. Check starter operation.

4-173. INITIAL RUN-UP TEST OF POWER PLANT PACKAGE AFTER INSTALLATION.

4-174. Perform preoperational test of installation (paragraph 4-172); then proceed as follows:

CAUTION

Turn engine over by hand to ensure that no oil lock is present in lower cylinders. If oil is present, loosen intake pipe gland nuts of lower three cylinders and rotate engine by hand until oil is drained. Tighten gland nuts.

a. Start engine in accordance with instructions contained in Handbook of Flight Operating Instructions.

b. Check oil pressure. Stop engine if oil pressure does not register within 10 seconds or reach 40 psi within 30 seconds.

c. Run engine at approximately 1000 rpm for approximately 3 minutes; then shut down engine and check power plant installation for fuel, oil, and hydraulic leaks.

d. Check oil tank level, and replenish oil supply as necessary.

e. Start and warm up engine (at 1200 to 1600 rpm with square-tip blade propeller, or 1200 to 1400 rpm with round-tip blade propellers) until oil pressure stabilizes and a definite increase in oil temperature is noted.

f. Check ignition system grounding (at 700 rpm) by momentarily turning ignition switch to "OFF" and then to "BOTH" to determine that engine stops firing.

g. Operate engine at approximately 1000 rpm, and check for oil pressure of 80 (±5) psi with oil temperature of 60°C (140°F). (Refer to paragraph 4-295 for pressure adjustment procedure.)

h. Check magneto drop at 2000 rpm. (Maximum allowable drop on either magneto is 100 rpm.)

i. Check for generator output by noting positive indication of amperage at 1150 to 1250 rpm.

j. Adjust idle mixture setting. (Refer to paragraph 4-207.)

k. At 2000 rpm, move propeller control to full "DECREASE RPM," and note 200 rpm drop; then return control to "INCREASE RPM."

l. Shut down engine, and check oil dilution system.

m. Inspect the entire power plant for leaks, loose nuts, and general condition of parts.

n. Remove, inspect, and clean engine oil screen assembly.

4-185. AIR INDUCTION SYSTEM.

4-186. The air induction system (figure 4-25) consists of an air scoop, air filter, air mixing chamber, and a control system for the air mixing chamber. Cold air is introduced at the left side of the engine compartment through a screened air scoop, which contains a removable carburetor air intake filter. The filter prevents dirt, dust, and any other foreign matter from entering the air induction system. The filter is of the wire-mesh Air Maze type. A frame holds the filter secure in a diagonal position across the air intake duct. The cold air passes through a duct assembly to the carburetor air mixing chamber. In order to provide a chamber for preheating air before it enters the mixing chamber, the exhaust collector ring is jacketed with a removable shroud. The air is heated as it circulates around the exhaust collector ring and is then conducted through the duct to the carburetor air mixing chamber. A control handle, mounted on the forward end of the control shelf at the left side of the front cockpit, is pulled back to admit hot air and pushed forward to admit cold air to the carburetor mixing chamber. Intermediate positions of the control will position the valves to allow varying amounts of hot and cold air to enter the mixing chamber.

4-187. TROUBLE SHOOTING AIR INDUCTION SYSTEM.

4-188. Refer to paragraph 4-158 for trouble shooting chart.

4-189. AIR MIXING CHAMBER.

4-190. The air mixing chamber is bolted to the lower inner portion of the engine fixed-ring cowling, and is interconnected withthe coldair inlet duct and the carburetor by means of slip-type joint assemblies. Incorporated in the mixing chamber is a gate for controlling the amounts of cold or hot air admitted to the carburetor.

4-191. REMOVING AIR MIXING CHAMBER AND AIR INLET DUCT. To remove the air mixing chamber and air inlet duct, proceed as follows:

a. Remove the upper left and the lower right and left sections of cowling.

b. Disconnect free air temperature bulbs and remove bolt securing air inlet duct to the fixed-ring cowl and to engine mount; then remove duct assembly.

c. Disconnect and remove oil cooler air scoop.

d. Disconnect the oil cooler support straps at the mixing chamber.

e. Disconnect operating linkage from bell crank.

f. Disconnect mixing chamber from fixed-ring cowl; then remove mixing chamber.

4-192. INSTALLING AIR MIXING CHAMBER AND AIR INLET DUCT. To install the air mixing chamber and inlet duct, proceed as follows:

a. Install and attach mixing chamber to fixed-ring cowl.

b. Connect the oil cooler support straps.

c. Connect operating linkage to bell crank on mixing chamber.

d. Install oil cooler air scoop.

e. Install air inlet duct and attach to fixed-ring cowl and engine mount; then install free air temperature bulbs.

f. Install sections of cowling removed for access to the units.

4-193. CARBURETOR AIR FILTER.

4-194. The carburetor air filter is of the Air Maze type, and is readily removed for cleaning by removing the upper left side cowl panel, releasing the dzus fastener at the top, and lifting the filter out of the duct.

4-195. CLEANING CARBURETOR AIR FILTER. To clean the carburetor air filter, proceed as follows:

a. Wash filter in cleaning solvent (Federal Specification No. P-S-661). Rock the filter or agitate the cleaning fluid to remove dirt from the innermost part of the filter element.

b. Thoroughly dry filter.

NOTE

Make sure filter element is thoroughly dry before it is immersed in oil; otherwise, oil will not adhere to element, resulting in impaired cleaning efficiency.

c. After filter is thoroughly dry, immerse filter in mixture of one part corrosion-preventive compound (Specification No. AN-VV-C-576, Type I) and three parts oil (Specification No. AN-O-8, Grade 1100 or 1120) from 2 to 5 minutes.

d. Drain filter for 24 hours to remove excess oil prior to use.

CAUTION

If filters are too heavily oiled, clogging will result.

4-196. ADJUSTING CARBURETOR AIR MIXING CHAMBER CONTROLS. See figure 4-30.

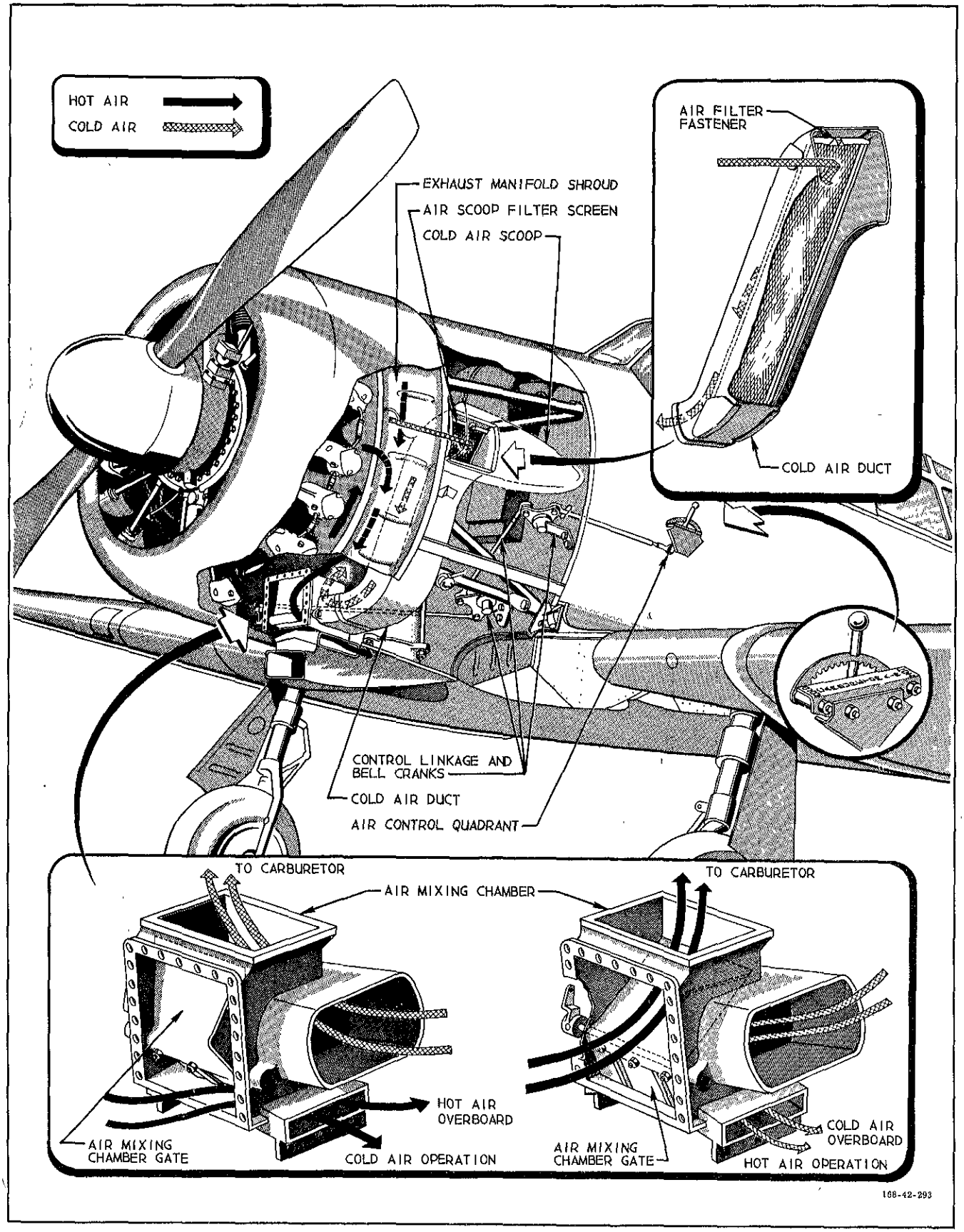


Figure 4-25. Air Induction System

4-197. FUEL REGULATION AND INJECTION SYSTEM.

4-198. The engine is equipped with a double-barrel, updraft, float-type carburetor, the function of which is to meter the correct amount of fuel to the engine, in proportion to the mass airflow. After being metered by the carburetor, the fuel is directed to the discharge nozzle, where it is mixed with incoming air and vaporized. The fuel-air mixture is then compressed by the impeller, and distributed to the cylinders through the intake pipes and inlet valves. A five-point priming system, fed by a hand primer pump, sprays fuel into the five upper cylinders. Fuel pressure reading to both cockpits is accomplished by a direct-reading system. A carburetor mixture (fuel-air) temperature indicating system, with an indicator in each cockpit, is installed in the airplane.

4-199. TROUBLE SHOOTING FUEL REGULATION AND INJECTION SYSTEM.

4-200. Refer to paragraph 4-158.

4-201. CARBURETOR.

4-202. The Bendix-Stromberg NAY9E1 float-type carburetor (figure 4-26) is a double-barrel, double-float chamber, updraft unit incorporating a mixture control unit, an accelerator pump, an economizer, an idling adjustment system, and an idle cutoff. The accelerator pump, operated by the throttle, delivers a positive and definite charge of fuel regardless of the suction existing in the carburetor, as a temporary enrichment of the mixture is required to obtain smooth and positive acceleration when the throttle is opened rapidly. The economizer opens a needle valve and allows additional fuel to pass from the float chamber through the economizer metering jet to supply the additional fuel necessary to enrich the mixture in the power range, give extra cooling to the cylinders, and prevent detonation. The idling system automatically furnishes a richer fuel-air ratio as required to keep the engine running smoothly at idling speeds. The idle cutoff stops the flow of fuel to the engine through the idle discharge nozzle, causing the engine to stop for lack of fuel. The idle cutoff feature becomes effective when the mixture control lever is in the "IDLE CUT-OFF" position.

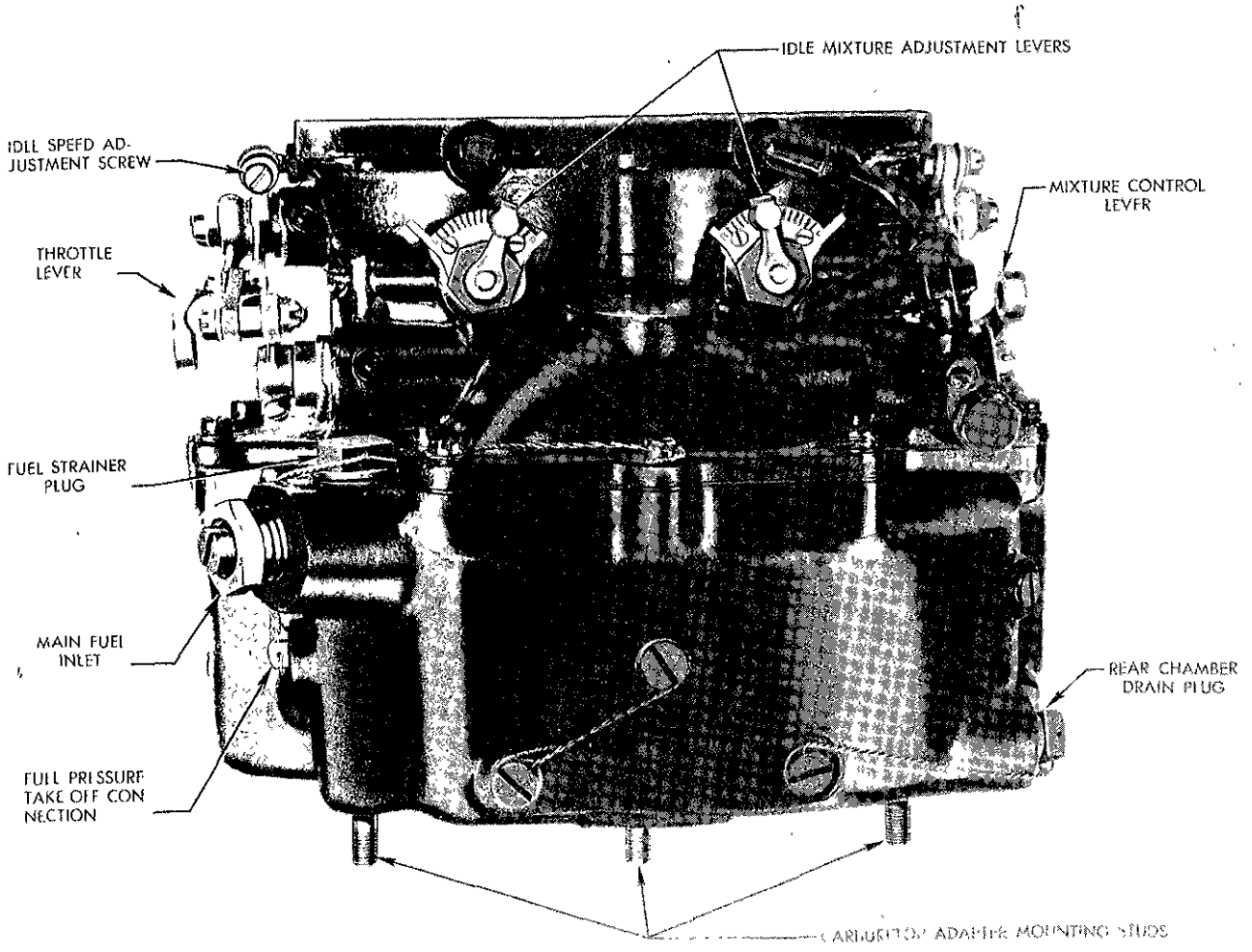


Figure 4-26. Carburetor

4-203. REMOVING CARBURETOR. To remove a carburetor, proceed as follows:

a. Remove engine accessory section cowling.

b. Disconnect fuel pressure gage line at carburetor.

c. Disconnect fuel lines to carburetor at both sides of "T" fitting.

d. Disconnect throttle and mixture control rods at carburetor.

e. Cut safety wire, and remove the six nuts and washers that hold carburetor to engine.

f. Remove the eight elastic stop nuts and washers that secure carburetor adapter to carburetor, and remove adapter. To remove the carburetor adapter, telescope the upper and lower halves together and secure by wrapping several turns of wire around the spring bosses on each end.

g. Disconnect engine-to-cooler oil line at oil cooler.

NOTE

It is necessary to disconnect this oil line to make room for removal of carburetor.

h. Carefully manipulate carburetor through left side of engine accessory section.

4-204. INSTALLING CARBURETOR. To install a carburetor, proceed as follows:

a. Make sure carburetor is clean and that all hold-down screws and plugs are tight and safetied. Check to see that carburetor engine flange studs are screwed sufficiently into flange to permit proper seating of carburetor on flange.

b. Place carburetor mounting gasket in position on carburetor, and carefully manipulate carburetor into position. Secure with six bolts, nuts, and washers. Safety with AN995F41 safety wire.

c. Install carburetor adapter, and secure to carburetor with eight elastic stop nuts and washers.

d. Connect throttle and mixture control rods. Adjust controls as explained in figures 4-27 and 4-28.

e. Connect fuel lines to carburetor inlet "T" fittings.

f. Connect fuel pressure gage line at carburetor.

g. Connect engine-to-cooler oil line at oil cooler.

h. Install engine accessory section cowling.

4-205. CLEANING CARBURETOR FUEL STRAINER. The fuel strainer, located at the top of carburetor main body above the fuel inlet (figure 4-26), is removed and cleaned as follows:

a. Cut safety wire, and remove fuel strainer plug and strainer.

b. Wash strainer in cleaning solvent (Federal Specification No. P-S-661) using a soft brush. Clean strainer chamber of accumulated dirt or water.

c. Reinstall strainer, making sure strainer gasket is in good condition.

d. Tighten plug and safety with AN995F41 safety wire.

4-206. PREPARING CARBURETOR FOR SERVICE. If the carburetor has been in storage, it must be cleaned and flushed of storage oil before being put into service. To prevent fuel leakage between the throttle body and the main body due to loose hold-down screws, all screws should be checked prior to installation. If necessary, cut safety wire, tighten the screws, and reinstall the safety wire. Leakage due to loose screws will impair the operation of the carburetor and create a serious fire hazard. All channel and headless screw plugs should be checked to make sure they are tight and properly safetied.

4-207. ADJUSTING CARBURETOR IDLE MIXTURE SETTING. Two small levers on the rear of the carburetor throttle body (figure 4-26) may be moved to control the richness of the mixture at idling speeds. Idle speed adjustment is accomplished by moving throttle arm stop screw on left side of carburetor. To reset idle adjustment, proceed as follows:

a. Start and warm up engine with airplane headed into wind. (Refer to paragraphs 3-56 and 3-58.)

b. Perform ignition check. Correct any ignition trouble before proceeding.

c. Close throttle and check for correct idle speed. Idle speed should be 450 rpm, with mixture control in "RICH" position. If necessary, adjust throttle idle stop screw on carburetor left side.

d. Clear engine by running it up to 1850 rpm. Reduce rpm to 550 (±50) and lock throttle. Make sure mixture control is in "RICH," and propeller control is in full "INCREASE RPM."

e. When engine speed has stabilized, move mixture control lever slowly toward the idle cutoff range, and carefully observe tachometer for any change in rpm; then move control to the "RICH" position before engine can stop. If engine speeds up more than approximately 15 rpm before the rpm drops off because of lack of fuel, the carburetor idle adjustment is set too rich and should be leaned. Turning the levers on the notched adjusting quadrants on rear of carburetor toward "L" will lean the mixture. If rpm drops immediately, the mixture is too lean and should be enriched. Turning the levers on the notched adjusting quadrants toward "R" will enrich the mixture.

f. Repeat step c. to readjust idle speed as required.

g. Advance throttle, and clear engine by running at approximately 1850 rpm for 10 seconds; repeat the cutoff check (step e.) if necessary.

4-208. ENGINE PRIMER SYSTEM.

4-209. The engine primer system (figure 4-54) consists of a hand primer pump (Parker 401), which is an entirely self-contained unit, and necessary plumbing to carry the fuel charge. The fuel is pumped by means of the hand primer pump from the discharge side of the fuel unit (on firewall) to the engine primer distributor mounted on cylinder No. 1 intake pipe. From the primer distributor, fuel is piped through lines and is diffused through jets in cylinders 8, 9, 1, 2, and 3, to assist in starting the engine. Fuel pressure for operation of the hand primer pump is supplied by the hand wobble pump. After operation of the engine primer pump, the handle should be turned to the "OFF" position to prevent possible siphoning of fuel should the vacuum check valve (in hand primer pump) fail.

4-210. ENGINE FUEL PRESSURE INDICATING SYSTEM.

4-211. The airplane is equipped with two direct-reading fuel pressure indicators that are located (one each) on the lower right side of each instrument panel, in the engine gage. Fuel pressure is transmitted by lines from the pressure side of the carburetor directly to the two indicators. The pressure lines and connections should be checked periodically for fuel leaks while under pressure. (Refer to paragraph 4-459 for further information concerning fuel pressure indicators.)

4-212. CARBURETOR MIXTURE TEMPERATURE INDICATING SYSTEM.

4-213. The carburetor mixture temperature indicating system consists of an electrical resistance-type thermometer bulb, two thermometer indicators (one in each cockpit), and necessary electrical wiring. The thermometer bulb is located in the engine air inlet, just above the carburetor, in the path of the fuel-air mixture. The thermometer indicators are located on the right-hand side of each instrument panel. The system operates as a modified fixed-resistance bridge, the thermometer bulb forming one leg of the bridge and the indicator in the cockpit forming the remainder of the bridge. Power for operation of the system is supplied by the 28-volt d-c electrical bus of the airplane. (For further information concerning the thermometer bulb and carburetor mixture temperature indicator, refer to paragraph 4-458.)

4-214. ENGINE CONTROLS.

4-215. Dual mechanical control of the engine is provided in each cockpit by three levers: throttle, mixture, and propeller. These levers are interconnected to their respective controlling units by push-pull rods and bell cranks. Carburetor air control is accomplished from the front cockpit only by means of a control lever mounted on the left side of the cockpit. The throttle, mixture, and propeller control levers in each cockpit are grouped in a control quadrant mounted on the left side of the cockpit. To provide control of power plant operation from either cockpit, the quadrants are interconnected by push-pull rods. System friction device is incorporated in the front cockpit quadrant only.

4-216. TROUBLE SHOOTING ENGINE CONTROLS.

4-217. Refer to paragraph 4-158.

4-218. INSTALLING AND REMOVING ENGINE CONTROLS.

4-219. Accessibility for installing, adjusting, and removing the engine control system components is unrestricted, except for the controls in the engine section. These require that all removable engine cowling be removed. The control rods are easily removed after being disconnected from quadrants, bell cranks, and operating units. When removing rods, a considerable amount of time will be saved during subsequent reinstallation if each rod is tagged as to its location, adjusted length, and connecting points.

4-220. ADJUSTING ENGINE CONTROLS.

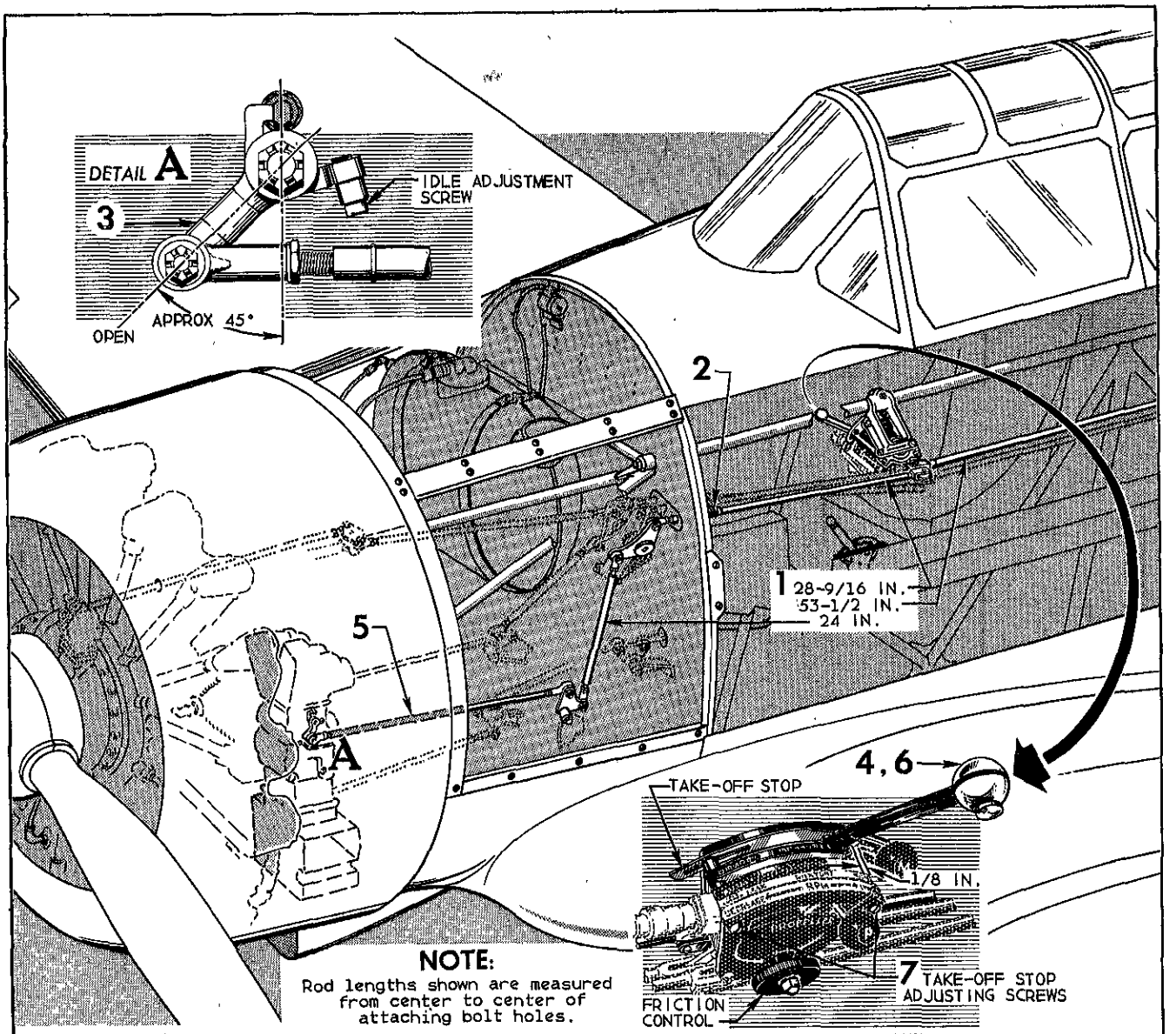
4-221. The engine controls in the fuselage, once adjusted, will require infrequent adjustments unless a quadrant or some other part is replaced. The adjustment of the fuselage portion of the controls is not disturbed when the engine is removed. Adjustment procedures for the individual engine controls are shown in figures 4-27 through 4-30.

4-222. ENGINE CONTROL QUADRANTS.

4-223. The engine control quadrants, one in each cockpit, provide control of the engine from either cockpit. The quadrants, clamped and bolted to the fuselage top frame tube on the left side of each cockpit, are interconnected by push-pull rods. Each quadrant incorporates a throttle, a mixture, and a propeller control lever. In addition, the front control quadrant has a friction control knob that provides anticreep friction for the three controls, and an adjustable throttle lever take-off, joggle-type stop. The throttle lever knob of each quadrant incorporates a radio button switch for the throat or boom-type microphones. The quadrants may be readily removed by disconnecting the control rods at the bottom of each quadrant, disconnecting the microphone lead plug at each quadrant, and then removing the bolts and clamps that secure the quadrants to the fuselage frame. Before removal of the quadrant, the fore and aft positions should be marked on the frame tubing. This will eliminate subsequent rod adjustments if initial rod adjustment is not disturbed.

4-224. THROTTLE CONTROL SYSTEM.

4-225. The throttle control system provides dual control of the carburetor arm as well as actuating force for the landing gear warning system. The forward movement of the quadrant throttle levers gives increasing throttle opening of the carburetor as indicated on



1 Adjust fuselage and firewall control rods to lengths shown. Operate control, and check for full travel, freedom of movement, clearance at all points, and equal travel between quadrant levers.

2 Move control lever fully forward; then pull firewall boot seal aft until fully extended. Secure seal to rod.

3 Rotate carburetor throttle shaft clockwise to the full open position; then index throttle arm on shaft so that arm is approximately 45 degrees forward as shown. Secure arm.

4 Move quadrant throttle levers forward (past take-off stop) until forward face of lever is 1/8 inch from end of travel slot. Lock control with friction control

5 Adjust control rod to fit (approximately 24 inches) and attach to carburetor throttle arm and firewall bell crank.

6 Operate control, and check for full travel, freedom of movement, and 1/16- to 1/4-inch spring-back in the "CLOSED" and "OPEN" positions at quadrant. Adjust rods as necessary to equalize and obtain proper spring-back.

7 Loosen take-off stop screws sufficiently to move stop; then slide stop fully aft. Start engine and advance throttle to obtain 36 in. Hg manifold pressure at 2250 rpm; then move throttle to the "CLOSED" position without moving stop. Stop engine. Tighten stop adjusting screws.

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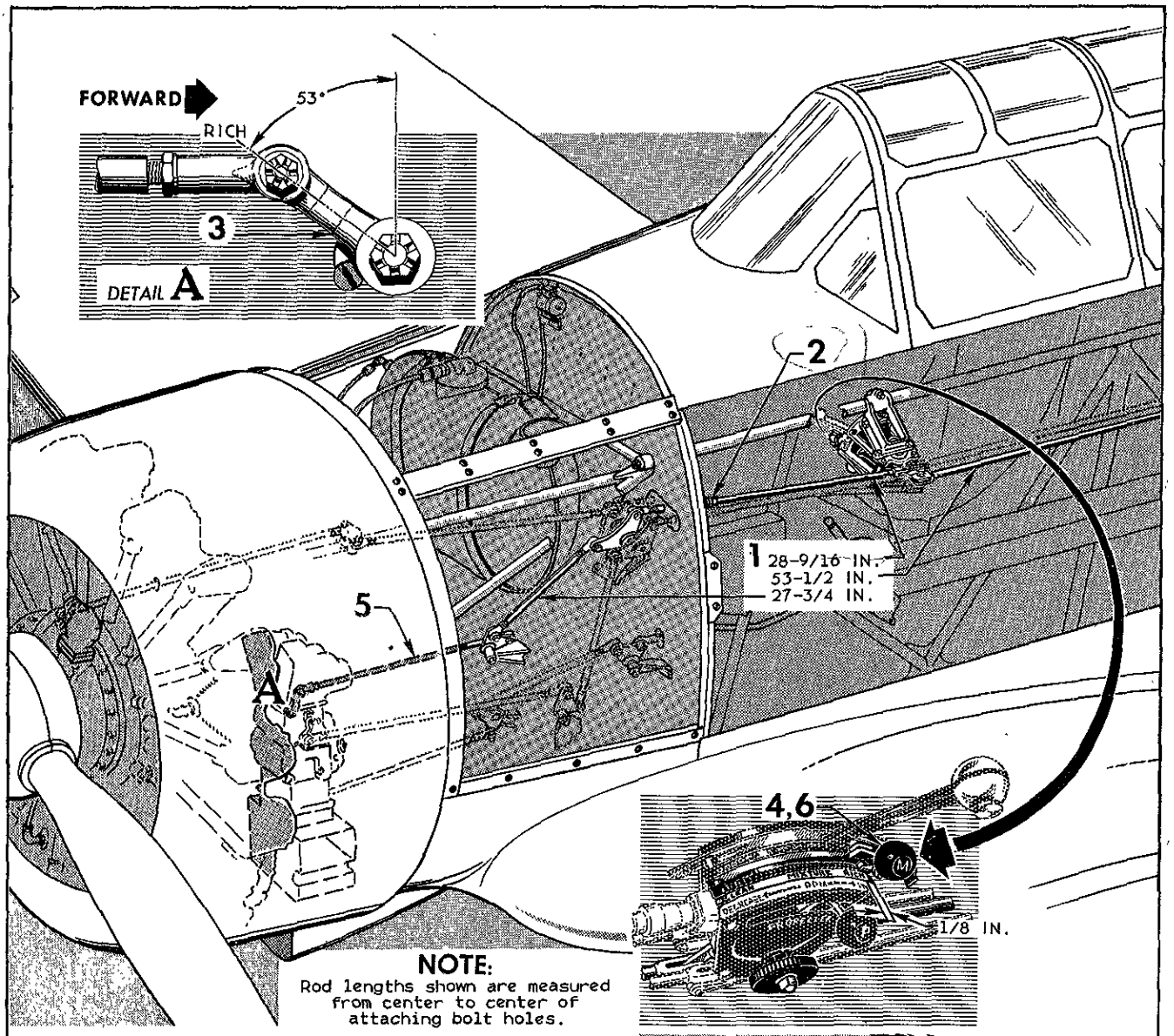
Figure 4-27. Adjusting Throttle Control System



1 Adjust fuselage and firewall control rods to lengths shown. Operate control, and check for full travel, freedom of movement, clearance at all points, and synchronized travel between quadrant levers.

2 Move quadrant control levers fully forward to the "RICH" position; then pull firewall boot seal aft until fully extended. Secure seal to rod.

3 Rotate carburetor mixture control shaft counterclockwise to the full "RICH" position; then index arm on shaft as shown.

4 Move quadrant mixture lever forward until front face of lever is approximately 1/8 inch from end of travel slot. Lock control with friction control.

5 Adjust control rod to fit (approximately 22-1/4 inch), and attach to carburetor mixture lever and firewall bell crank.

6 Operate control, and check for full travel, freedom of movement, and 1/16- to 1/4-inch spring-back in the full "RICH" and "IDLE CUT-OFF" positions at quadrant. Adjust rods as necessary to obtain and equalize spring-back.

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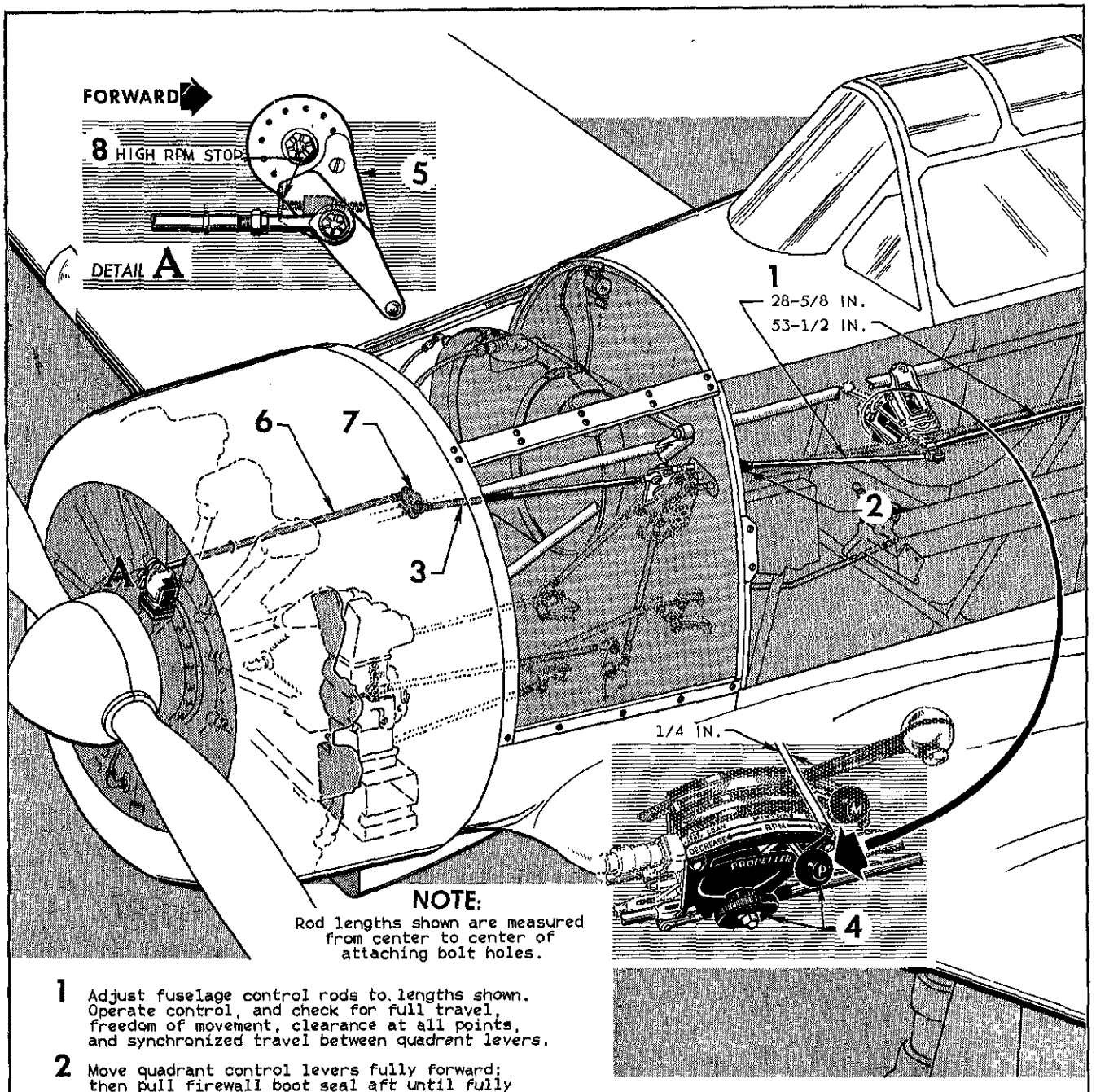
Figure 4-28. Adjusting Mixture Control System



1 Adjust fuselage control rods to lengths shown. Operate control, and check for full travel, freedom of movement, clearance at all points, and synchronized travel between quadrant levers.

2 Move quadrant control levers fully forward; then pull firewall boot seal aft until fully extended. Secure seal to rod.

3 Adjust rod to 23-inch length.

4 Move quadrant propeller control levers forward until forward face of lever is 1/4 inch from end of travel slot. Lock control with friction control.

5 Rotate governor control arm to the high rpm stop.

6 Adjust control rod to fit (approximately 27-3/4 inches) and attach to positioned governor arm and bell crank.

7 Operate control, and check for full travel, freedom of movement, rod and bell crank clearance at all points of travel, and 1/8- to 1/4-inch spring-back in the "INCREASE RPM" position. Stake bell crank bracket to engine mount.

8 Start engine, and adjust governor high rpm stop and/or linkage to obtain 2250 rpm. If proper rpm cannot be obtained by stop or linkage adjustment, remove and replace governor. (Refer to index for page number of applicable procedure.)

168-43-108

Figure 4-29. Adjusting Propeller Control System

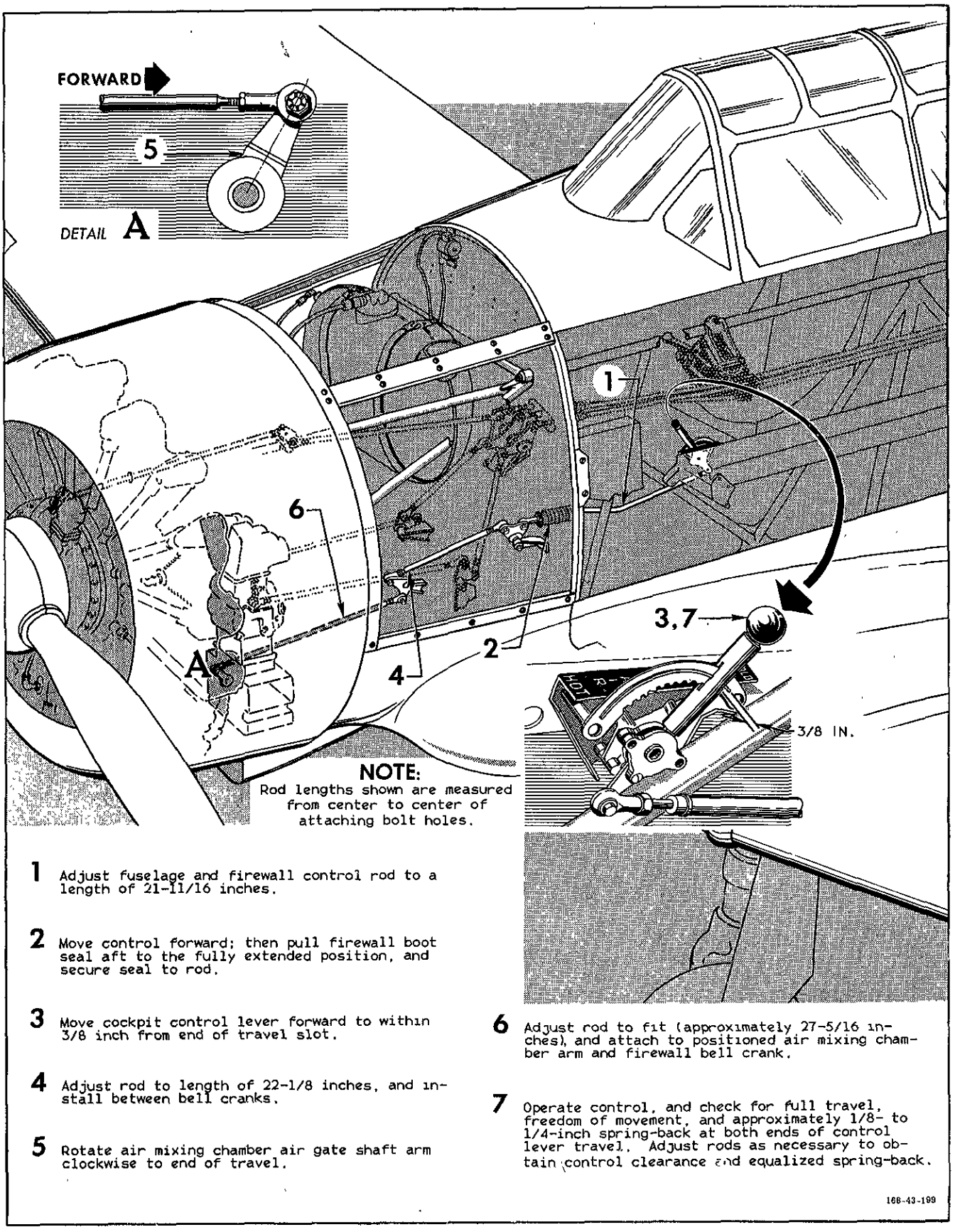


Figure 4-30. Adjusting Carburetor Air Control System

the quadrants. An adjustable joggle-type stop incorporated in the front quadrant is provided to limit the throttle lever travel for maximum take-off power of 36 in. Hg manifold pressure at 2250 rpm at sea level. To obtain additional power in case of emergency, the throttle lever may be advanced beyond the stop. The landing gear warning switch, located on the firewall and connected by linkage to the upper firewall bell crank of the throttle control system, is closed by throttle action when either throttle is retarded to within 7/16 inch of the "CLOSED" quadrant position. When the switch is closed when the landing gear is up, the landing gear warning horn will sound.

4-226. ADJUSTING THROTTLE CONTROL SYSTEM. Adjust the throttle control system as shown in figure 4-27.

4-227. MIXTURE CONTROL SYSTEM.

4-228. The mixture control system provides remote control of the carburetor mixture control arm by means of push-pull rods, bell cranks, and a mixture control lever in each cockpit. The control quadrant marked positions are "IDLE CUT-OFF" and "RICH" at the extremities of travel. When the control lever is in the extreme aft position, the carburetor is in the idle cutoff range. The front quadrant mixture control lever is equipped with a spring-loaded lock and ratchet. The locking feature prevents inadvertent movement of the mixture control to the "IDLE CUT-OFF" position from the front cockpit, as well as preventing the rear cockpit occupant from leaning the mixture. The control lock is ineffective when moving either control lever forward toward the "RICH" position. To move the control toward the "IDLE CUT-OFF" position, the occupant of the front cockpit must press forward on the lock lever attached to the mixture control lever. As soon as the lock lever is released, the lock feature again engages.

4-229. ADJUSTING MIXTURE CONTROL SYSTEM. To adjust the mixture control system, see figure 4-28.

4-230. PROPELLER CONTROL SYSTEM.

4-231. Propeller governor setting is accomplished from either cockpit by means of push-pull rods, bell cranks, and a propeller control lever in each quadrant. Forward movement of either quadrant propeller control lever selects a governor setting that provides an increase in rpm.

4-232. ADJUSTING PROPELLER CONTROL SYSTEM. To adjust propeller control, see figure 4-29.

4-233. CARBURETOR AIR CONTROL SYSTEM.

4-234. Selection of carburetor air is accomplished from the front cockpit only, by a push-pull rod and bell crank mechanical system that operates an air gate in the air mixing chamber, located under the carburetor. The control handle is located at the left side of the front cockpit immediately under the engine control quadrant. When moved forward, the control positions the air gate to select outside cold filtered air. When the control is moved aft, the air gate is positioned to select hot air from around the engine. The spring-loaded control handle is provided with detents to utilize intermediate position to allow varying combinations of hot and cold air to maintain desired carburetor air inlet temperature.

4-235. ADJUSTING CARBURETOR AIR CONTROL SYSTEM. To adjust carburetor air control system, see figure 4-30.

4-236. PROPELLER.

4-237. The airplane is equipped with a two-blade, constant-speed, counterweight-type Hamilton Standard propeller. (See figure 4-31.) The propeller assembly consists essentially of the following major components: propeller hub (Hamilton Standard 12D40-211, modified in accordance with NAA Drawing No. 168-44004); propeller blade assembly (Hamilton Standard 6101A-20, or 6101A-12, -13, or -14); propeller governor (Hamilton Standard 1M12); propeller spinner (Type D174-AF, Drawing No. 42J15621, modified in accordance with NAA Drawing No. 168-44002); push-pull rods, bell cranks, control levers, and necessary connecting mechanical linkages to permit automatic as well as manual control of propeller blade pitch from either cockpit. No provisions are made for feathering the propeller. Automatic propeller blade angle changes, necessary to maintain constant engine speed under varying flight conditions, are controlled by the governor.

4-238. OPERATION OF PROPELLER.

4-239. Blade angle variations required for operation of the constant-speed, counterweight-type propeller are controlled by the following forces: the centrifugal twisting moment of a rotating propeller blade which always acts to move the blade angle toward low pitch (high engine rpm); the centrifugal force (exerted by the counterweights) which tends to move the blades, through mechanical linkage, toward high pitch (low engine rpm); and engine oil under governor-boosted pressure controlled by the governor which, supplemented by the centrifugal twisting moment of a rotating propeller, can overcome the centrifugal pull of the counterweights to maintain constant speed under varying flight conditions. As the engine rpm increases, the centrifugal force exerted by the counterweights becomes sufficient to overcome the centrifugal twisting moment exerted by the propeller blades. Since the governor-boosted engine oil pressure in the propeller cylinder holds the blades at low pitch (high engine rpm) and prevents the pull of centrifugal force on the counterweights from turning the blades to high pitch, the blades will move to high pitch as soon as the oil pressure is released. The required balance between the oil force in the propeller cylinder and the centrifugal force of the propeller counterweights is

maintained by the propeller governor, which either meters oil to, or allows it to drain from, the propeller cylinder in the quantity necessary to maintain the proper blade angle for constant-speed operation. The rpm at which the propeller will operate is regulated in the head of the flyweight-type governor by moving the propeller control (in either cockpit), which is connected to the governor by bell cranks and mechanical linkages

4-240. TROUBLE SHOOTING PROPELLER.

TROUBLE	PROBABLE CAUSE	REMEDY
Inability to attain take-off rpm.	Faulty tachometer.	Replace tachometer.
	Sticky governor pilot valve.	Remove and replace governor.
	Sticky governor relief valve.	Remove and replace governor.
	Wrong setting of governor	Adjust governor.
	Wrong adjustment of controls.	Adjust controls.
	Excessive engine transfer ring leakage.	Replace ring.
	Inadequate oil supply.	Check oil supply source.
	Improper setting of stop nuts on adjusting screw in counterweight.	Remove counterweight caps. Reset and check nuts.
	Wrong indexing of counterweight bracket on blade bushing.	Replace propeller.
Rough propeller operation.	Propeller unbalance.	Remove and replace propeller.
	Cocked cylinder.	Remove counterweights and adjust setting of stop nuts on adjusting screw.
	Blades out of track.	Remove and replace propeller.
	Propeller loose on engine shaft.	Inspect propeller shaft for runout; check front and rear cones for galling. Remove scratches from cone with crocus cloth. Clean cones; then reinstall propeller, tightening to proper torque.
	Front cone halves not matched.	Install matched cone.
	Excessive propeller shaft runout.	Replace engine if necessary.
	Blade angles vary among blades.	Check for bent or twisted blades. If blades are bent or twisted, remove and replace propeller.
Oil leakage between cylinder head and cylinder.	Cylinder head gasket worn or damaged.	Replace gasket.
	Cylinder head loose.	Tighten cylinder head.
Oil leakage at base of cylinder.	Piston "O" ring seal damaged.	Replace "O" ring seal.
	Loose piston oil seal nut or faulty gasket.	Tighten and safety nut, or replace gasket.
	Cylinder sleeve ID too large.	Check cylinder sleeve. Any cylinder sleeve found to have an ID 4.550 +0.015 inches shall have the cylinder sleeve replaced and reground to standard dimension.

TROUBLE	PROBABLE CAUSE	REMEDY
	Cylinder scored.	Replace sleeve and regrind to standard dimension.
Oil leakage at rear cone.	Loose piston.	Tighten piston.
	Front cone packing washer damaged.	Install new front cone packing washer.
Grease leakage between spider and barrel.	Worn or damaged grease retainer.	Remove and replace propeller.
	Grease retainer blown because of excessive lubricating pressure.	Remove and replace propeller.
	Grease accidentally pumped into propeller while lubricating.	Remove and replace propeller.
Grease leakage from counterweights.	Excessive amount of grease in counterweight bracket assembly.	Remove counterweight caps, and wipe off excess grease.
Overspeeding.	Too rapid opening of throttle.	Advance throttle evenly and slowly.
	Faulty tachometer system.	Repair tachometer system; replace tachometer if necessary.
	Damaged or incorrect gasket between governor base and engine mounting pad.	Install correct new gasket.
	Sticky governor pilot valve.	Remove and replace governor.
	Sticky governor relief valve.	Replace governor.
	Wrong setting on governor.	Reset governor.
	Improper setting on stop nuts on adjusting screw in counterweight.	Remove counterweight cap, and correct stop nut settings.
	Angles wrong because counterweight improperly stamped.	Remove and replace propeller.
	Wrong base blade setting between bracket and bushing.	Remove and replace propeller.

4-241. REMOVING PROPELLER.

4-242. The parts and components referred to are indentified in figure 4-31. A suitable container should be available to catch approximately one quart of engine oil when the propeller cylinder head is removed. To remove the propeller, proceed as follows:

a. Make sure ignition switch is "OFF."

WARNING

Before moving propeller, be sure ignition ground lead plug is connected to receptacle at firewall. If the ignition ground lead plug is not grounded, the ignition system of the airplane is operative the same as though the ignition switch were "ON," and the engine may fire if the propeller is moved.

b. Retard propeller control to full "DECREASE" rpm.

NOTE

Retarding propeller control positions governor pilot valve to return engine oil from propeller piston to engine.

c. Move propeller blades to full high pitch position, using two blade turning devices (Hamilton Standard M-712), one on each blade, to prevent binding.

d. Remove propeller spinner front section.

e. Remove cylinder head lock ring, and unscrew cylinder head. A container should be available to catch the engine oil that will run from cylinder.

f. Remove cylinder head gasket from cylinder.

g. Remove cotter pin; then, with wrench (M-1089), remove propeller piston oil seal nut.

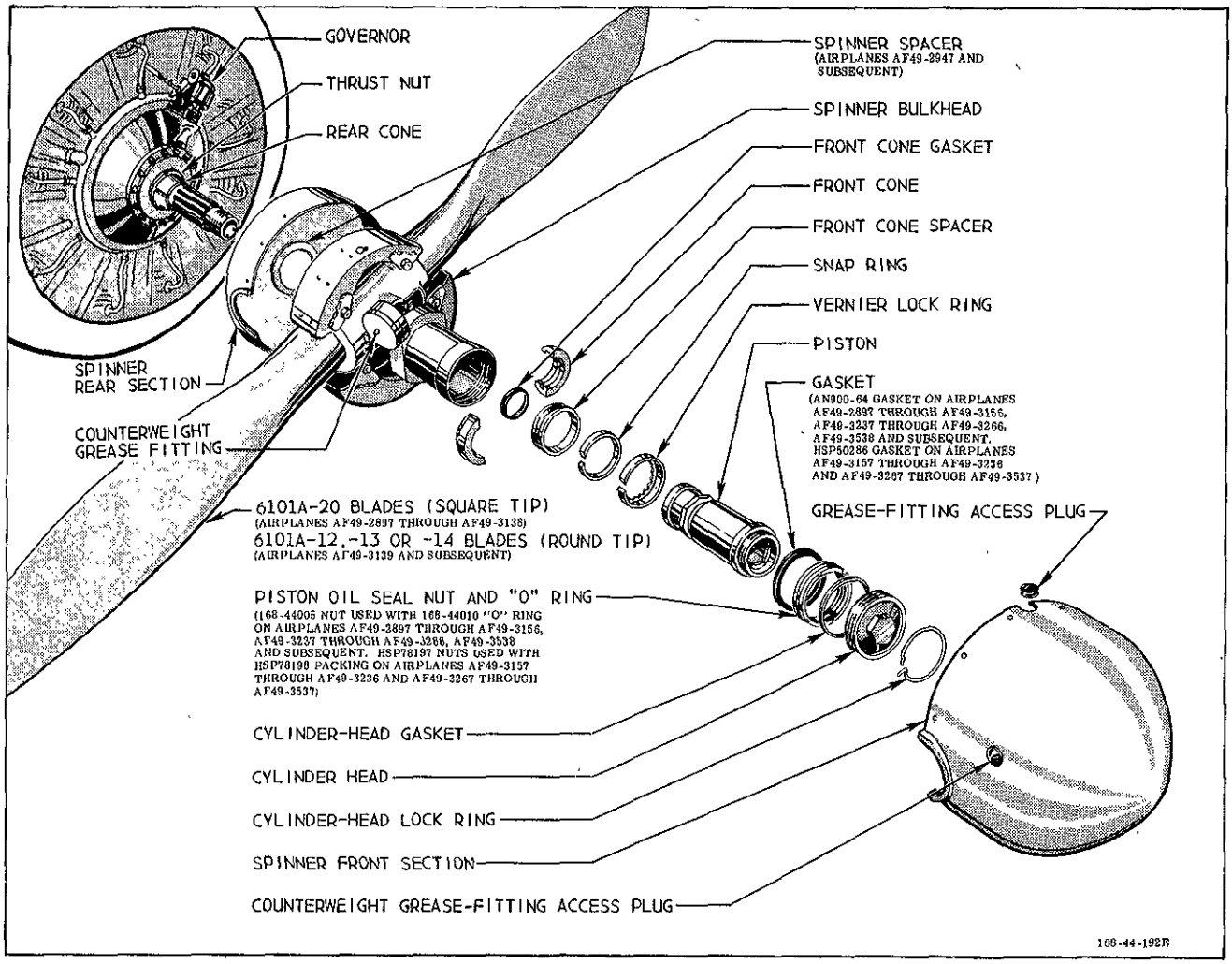


Figure 4-31. Propeller Installation

NOTE

(Deleted)

h. Move blades to position near low angle setting, and remove two cotter pins from vernier lock ring. Slide vernier lock ring away from spider.

i. Attach a hoisting sling to propeller blades and, using proper wrench (M-1089) and bar, unscrew piston completely off propeller shaft threads.

NOTE

As piston is unscrewed, front cone spacer contacts hub snap ring, thus partially backing propeller off shaft with piston.

j. Disengage hub snap ring from spider; then remove front cone, front cone packing washer, front cone spacer, hub snap ring, and piston vernier lock ring from piston. Remove piston from cylinder.

k. Cover propeller shaft threads with thread protector (8003-44D26138-40) or, if suitable thread protector is not available, wrap threads with tape.

l. Slide propeller off shaft, being careful not to damage shaft threads and splines of shaft or spider.

m. Place propeller on suitable rack or dolly.

n. Clean, oil, and cover propeller shaft if another propeller is not to be installed immediately.

o. If propeller is to be stored, all metal surfaces should be protected against corrosion by applying a coat of corrosion-preventive compound (Specification No. AN-VV-C-576).

p. If propeller is not to be reinstalled, remove spinner rear section and bulkhead for installation on new propeller.

4-243. INSTALLING PROPELLER.

4-244. Before installing propeller, treat the propeller shaft with corrosion-preventive compound (Specification No. AN-C-124). All corrosion and all raised points of nicks, burrs, galls, etc, on joining surfaces of crankshaft end must be carefully dressed off, and parts must be thoroughly cleaned

pitch, using blade turning devices. (Both blades should be turned in unison to avoid cocking cylinder.)

CAUTION

Use care during blade turning operation to move both propeller blades at same time, and not to pull propeller off shaft.

k. Remove thread protector or tape from propeller shaft threads, and inspect for damage. Stone out any burrs.

l. Coat shaft threads of piston with antiseize compound (Specification No. JAN-A-669), and coat entire piston with clean engine oil (Specification No. MIL-O-6082); then insert piston into the cylinder. (See figure 4-35.)

m. Place piston vernier lock ring over inboard end of piston with flange of lock ring forward; then install hub snap ring and front cone spacer (in that order) over end of piston, and push them out against vernier lock ring. (See figure 4-36.)

n. Lightly coat front cone packing washer and front cone with clean engine oil (Specification No. MIL-O-6082), and place beveled end of packing washer against beveled inboard end of piston. Check pair numbers stamped on two front cone halves for agreement; then assemble cone halves around piston flange. Fit packing washer into its position in inside groove of front cone. Make sure that packing washer is properly seated against piston and in front cone groove. (See detail of figure 4-38.)

o. Slide piston and front cone assembly into spider until it contacts shaft threads. Carefully align piston and shaft threads; then screw piston onto shaft by hand. Using a short bar (1-1/2 to 2 feet) in propeller installation wrench (Hamilton Standard M-1089), tighten piston until snug. (See figure 4-37.)

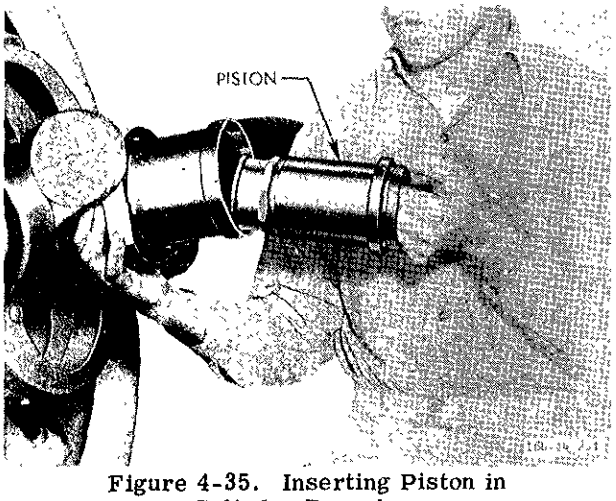


Figure 4-35. Inserting Piston in Cylinder Barrel

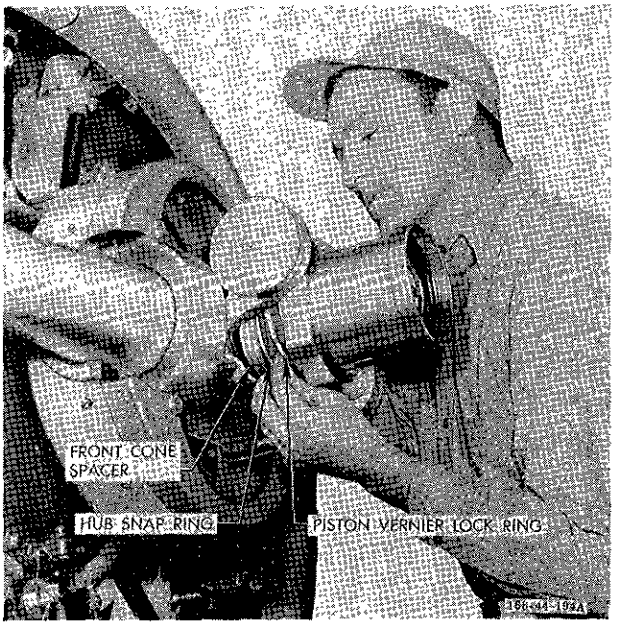


Figure 4-36. Installing Piston Vernier Lock Ring, Hub Snap Ring and Front Cone Spacer

CAUTION

Be sure dome aligns properly and does not cock. In no case should force be used to tighten piston if there is any indication of binding or if threads are not properly engaged, since this may cause serious damage to threads. If piston does not turn freely on shaft, make sure blades are not set at different angles. Make sure that front cone packing washer is properly seated, and inspect piston and shaft threads for damage.

p. Install hub snap ring in spider with screwdriver. (See figure 4-39.)

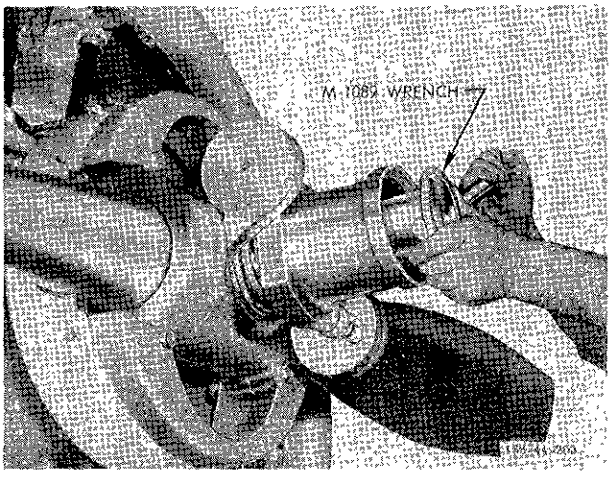


Figure 4-37. Tightening Piston

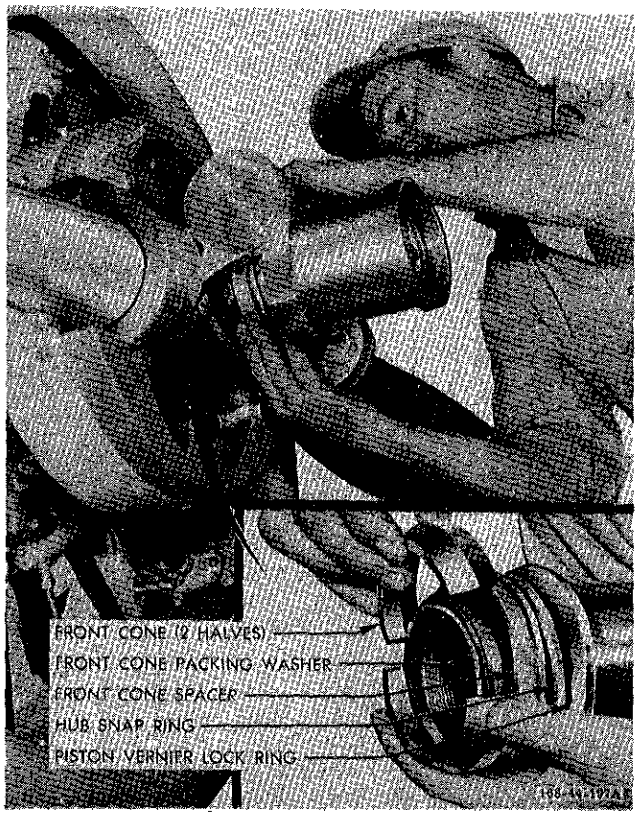


Figure 4-38. Installing Packing Washer and Front Cone

q. Finish tightening piston by blocking blade and applying a steady torque of 180 pounds on the end of a 4-foot bar inserted into the propeller installation wrench (Hamilton Standard M-1089). (See figure 4-40.) Tap bar once near wrench with a 2-1/2 pound hammer to finally secure the assembly.

r. Position piston vernier lock ring in top of spider around octagon portion of piston so that two of the four cotter pin holes, in outboard end of spider, line up **with two of the eight cotter pin holes in vernier lock**

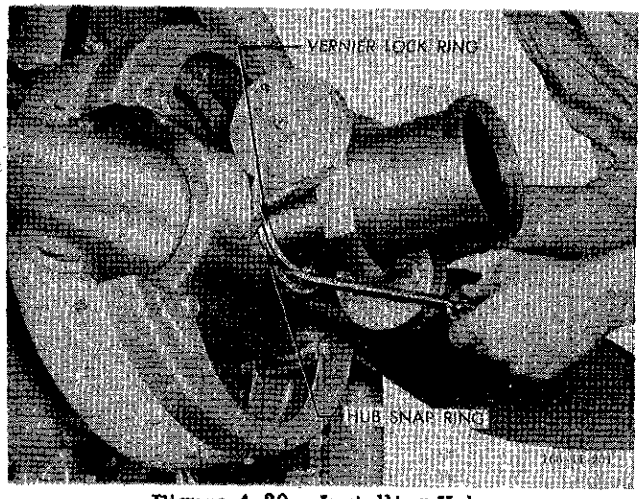


Figure 4-39. Installing Hub Snap Ring

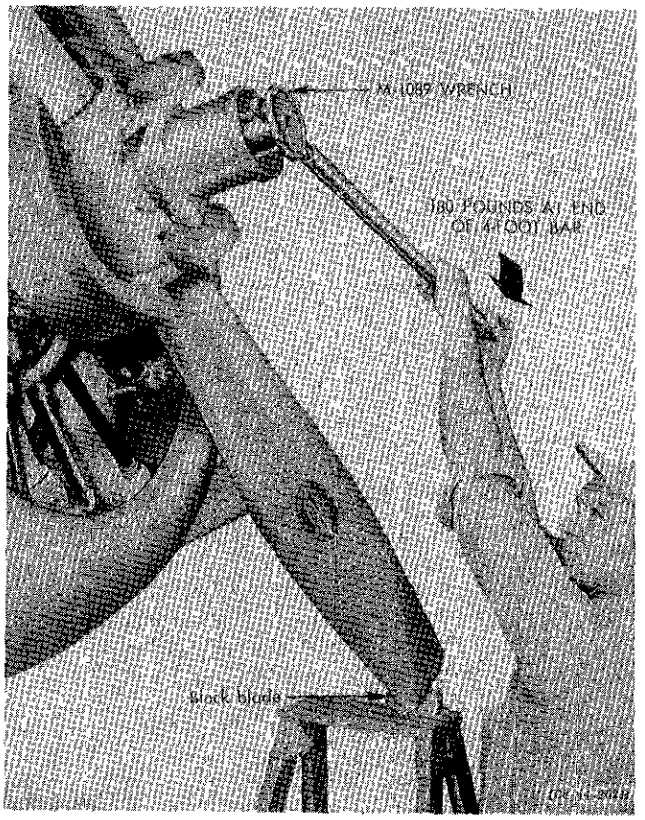


Figure 4-40. Torquing Piston

ring. Safety vernier lock ring to spider with a cotter pin in each of the two sets of aligned holes. The cotter pins should be installed with the heads facing toward piston. This can be done by bending cotter pins slightly to clear side of piston. (See figure 4-41.)

s. Using a blade turning device, turn blades so propeller cylinder protrudes approximately one inch forward of full high pitch position.

sA. On Airplanes AF49-3157 through AF49-3236 and AF49-3267 through AF49-3537, install piston gasket.

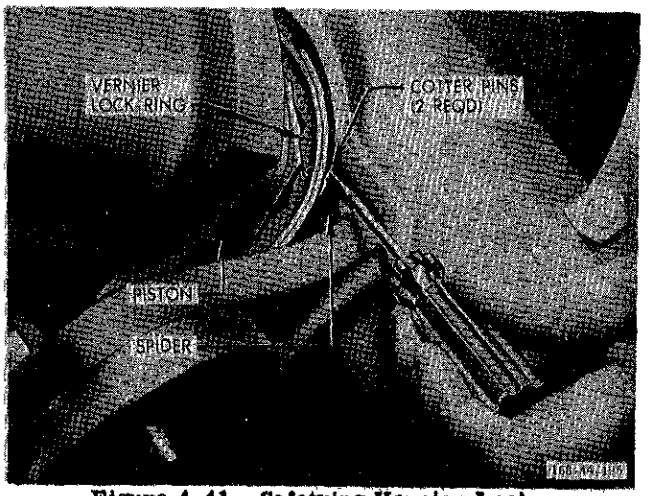


Figure 4-41. Safetying Vernier Lock Ring to Spider

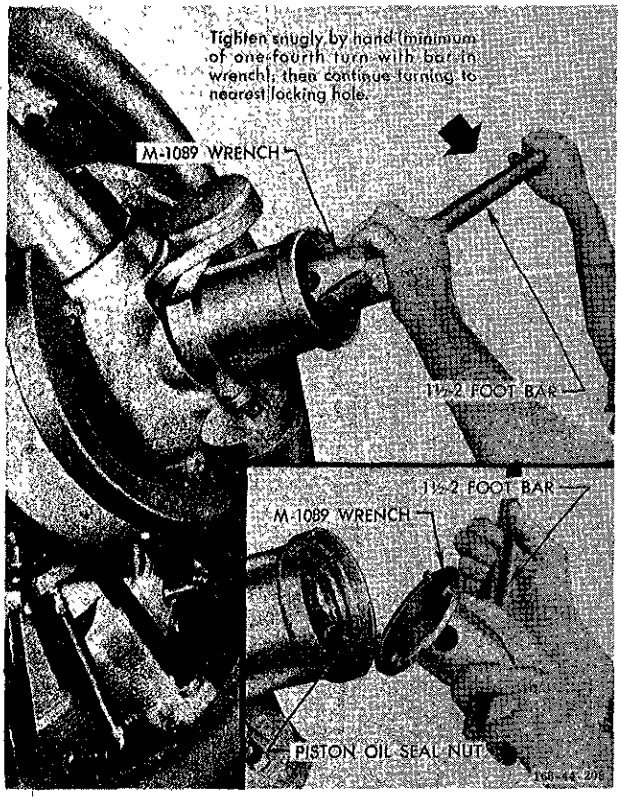


Figure 4-42. Tightening Piston Oil Seal Nut

t. Install "O" ring or packing on piston oil seal nut, and fill groove around "O" ring or packing with grease (Specification No. MIL-L-7711).

NOTE

On Airplanes AF49-2897 through AF49-3156, AF49-3237 through AF49-3266, and AF49-3538 and subsequent, a copper gasket (AN900-64) is secured to piston oil seal nut with clear lacquer to aid in installation. If gasket comes loose, nut and gasket should be cleaned, and gasket should be again cemented to nut with **clear lacquer.**

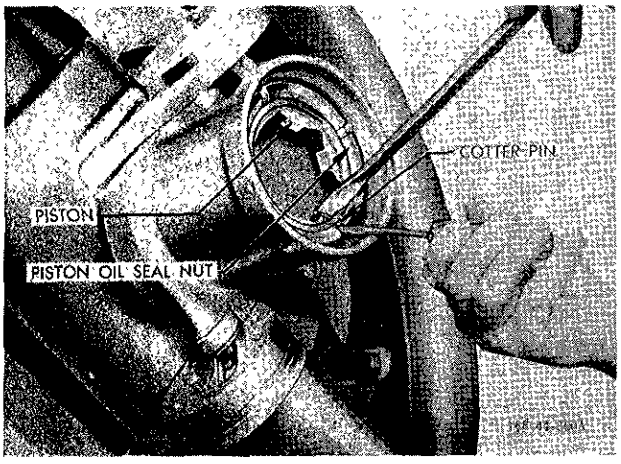


Figure 4-43. Safetying Propeller Piston Oil Seal Nut

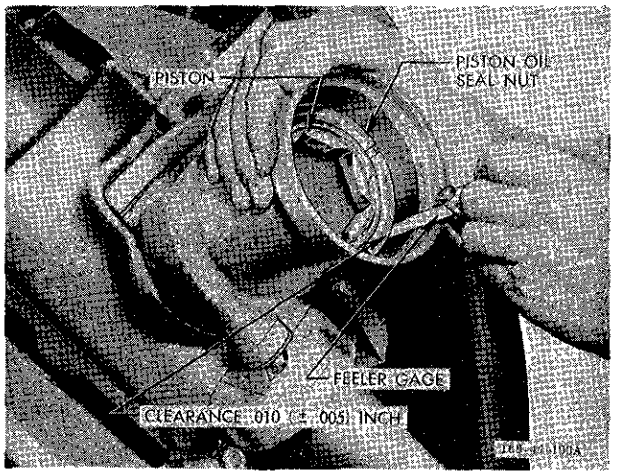


Figure 4-44. Checking Cylinder Barrel and Piston Nut Clearance

u. Install piston oil seal nut in end of hub, and tighten snugly by hand; then, with bar in wrench, turn minimum of one-fourth turn. Continue turning to nearest locking hole. (See figure 4-42.) Safety with cotter pin. (See figure 4-43.)

v. Using a feeler gage, check clearance between cylinder barrel and piston oil seal nut, which should be as shown in figure 4-44 when propeller hub is pushed and held to one side. Use only hands to hold hub.

NOTE

Piston oil seal nuts in oversize condition not to exceed .015 inch may be used where required ±.010-inch clearance cannot otherwise be maintained.

w. Place cylinder head gasket on its seat in end of cylinder, with split face against cylinder (figure 4-45); then screw cylinder head into cylinder and tighten firmly, using wrench (Hamilton Standard M-1089) and a bar 1-1/2 to 2 feet in length.

x. Line up one of the locking holes in the cylinder head with a locking hole in the cylinder. Install cylinder head lock ring and snap into groove in cylinder head. (See figure 4-46.)

y. Grease propeller. (Refer to paragraph 3-73.)

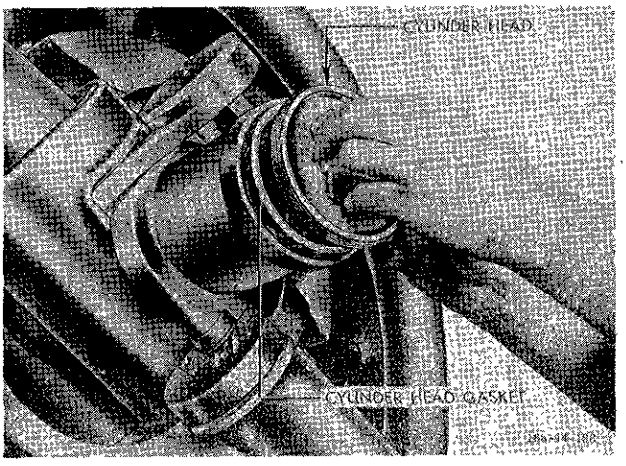


Figure 4-45. Installing Cylinder Head and Gasket

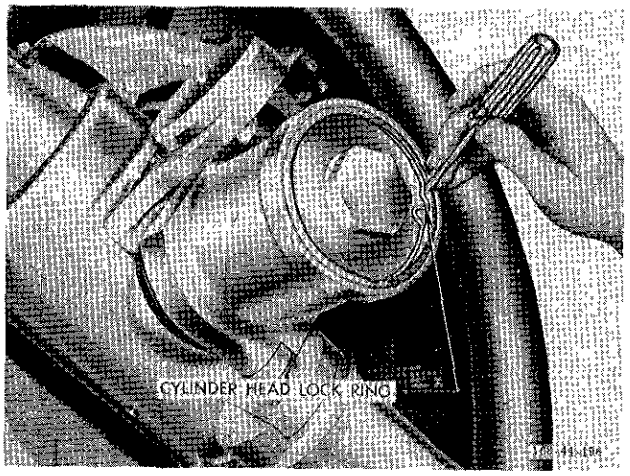


Figure 4-46. Installing Cylinder Head Lock Ring

z. Install propeller spinner front section. Safety front and rear section screw heads together in pairs. (See figure 4-47.)

aa. Insert rubber plugs into grease holes in propeller spinner front section. (See figure 4-47.)

ab. Warm up engine and operate for approximately 15 minutes.

ac. Retorque propeller for tightness.

4-245. PROPELLER BLADE ASSEMBLY.

4-246. The propeller blade assembly consists of two aluminum alloy blades (Hamilton Standard 6101A-20, on Airplanes AF49-2897 through AF49-3138; and 6101A-12, -13, or -14, on Airplanes AF49-3139 and subsequent). Blade angle settings taken at the 42-inch reference station are 14.5 degrees for low pitch and 29 degrees for high pitch. Base setting on the blade bushing is 29 degrees. Both types of blades are interchangeable in pairs; however, when No. 6101A-12, -13, or -14 blades are used, it is necessary to change the blade angle settings. Blade angle settings for Hamilton Standard 6101A-12, -13, or -14 blades (at the 42-inch reference station) are 13 degrees for low pitch and 28 degrees for high pitch, with base setting on the blade bushing of 28 degrees.

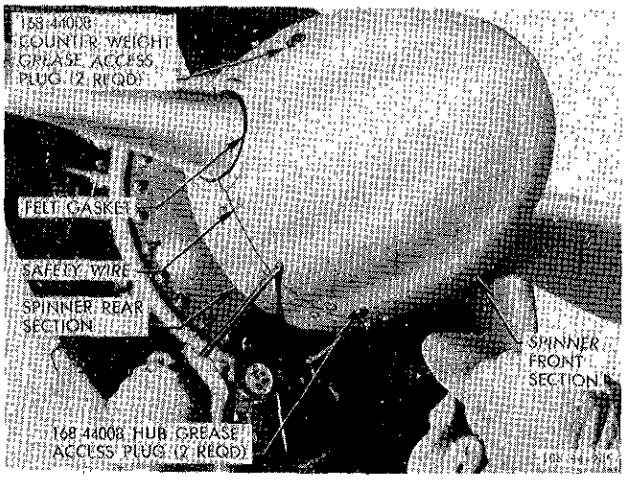


Figure 4-47. Installing Propeller Spinner

4-247. CHECKING AND ADJUSTING PROPELLER BLADE ANGLE SETTINGS. Blade angle settings are adjustable by means of screw assemblies in the counterweight slots. (See figure 4-48.) Check high-pitch blade angle by turning both blades toward high pitch until counterweight bearing shafts are firmly in contact with adjusting screw nuts; then, using a propeller protractor, check blade angle of each blade at 42-inch reference station. Blade angles should be within 0.1 degree of high angle setting. Turn blades toward low pitch until the counterweight bearing shafts are firmly in contact with the adjusting screw nuts. Check blade angles at 42-inch reference station. Blade angles should be within 0.3 degree of low angle setting and within 0.2 degree of each other. If blade angles are not within the specified tolerance, adjust propeller blade angle settings as follows:

a. Remove spinner front section.

b. Remove counterweight caps.

c. Turn blades slightly toward low pitch in order to move counterweight bearing shafts away from counterweight slots.

d. Check position of the two adjusting screw nuts relative to graduated scale stamped on one side of counterweight slot.

NOTE

The numbers on graduated scale in counterweight denote blade angle range and not actual blade angles. To determine how to set the nuts to obtain desired high and low blade angle settings, subtract high angle setting from base setting of propeller. The base setting is stamped on lead plug adjacent to slot in counterweight.

e. Adjust high blade angle by setting flat face of lower adjusting nut in line with marking which indicates difference (if any) between desired high angle setting and base setting.

NOTE

The lower nut limits high blade angle setting, while upper nut limits low blade angle setting.

f. Adjust low blade angle by setting flat face of upper adjusting nut in line with marking which represents difference (if any) between desired low angle setting and base setting.

g. Install counterweight caps and screw down snugly. Lock caps with locking pin and cotter pin.

NOTE

Make sure that the position number on the inside face of the caps agrees with the position number of the brackets.

h. Grease counterweights. (See figure 3-10.)

i. Install propeller spinner front section. Safety front and rear section screw heads together in pairs. (See figure 4-47.)

4-247A. CHECKING AND ADJUSTING COUNTERWEIGHT THRUST WASHERS. Check clearance between counterweight brackets and thrust washers. This clearance should be between .003 and .006 inch at the tightest point in the angular range of the brackets. To check clearance, insert a .003-inch thick horseshoe-shaped shim between one of the brackets and its thrust washer, and check clearance between the other bracket and thrust washer. The clearance is satisfactory if, with the .003-inch thick shim in place between the first bracket and thrust washer, it is possible to insert a .003-inch thick shim and impossible to insert a shim thicker than .006 inch between the second bracket and thrust washer. Repeat this check in the same way with the first bracket.

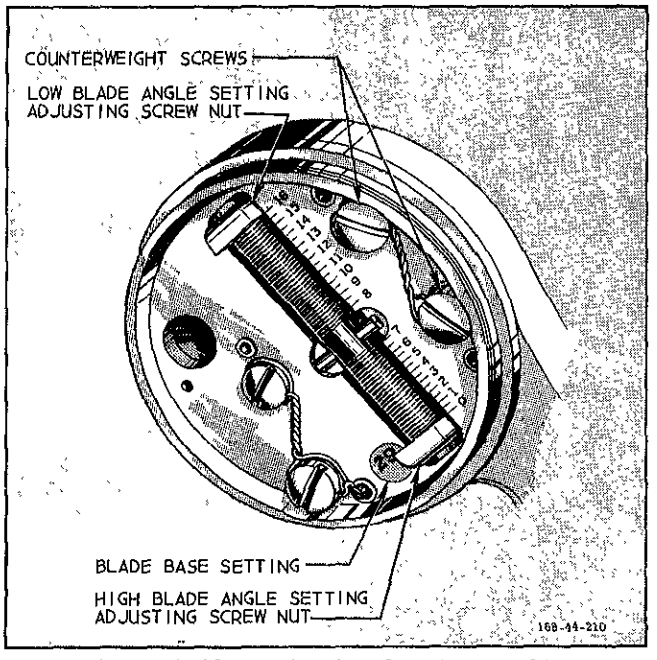


Figure 4-48. Adjusting Counterweight Pitch Stop Settings

4-248. PROPELLER HUB ASSEMBLY.

4-249. The propeller hub assembly consists of the spider, barrel, and miscellaneous smaller parts. The arm bearing surfaces are lubricated through small passages which extend from inside the hollow portion of the arm to grease fittings located between the arms. The barrel is the casing that encloses the hub group and the butt ends of the blade assemblies. The barrel is in half-sections that are ground and balanced as a pair; therefore, the halves are not interchangeable and must be kept together throughout the service life of the propeller. The barrel halves are held together by four bolts and nuts which extend through bosses incorporated on each half near the parting surface. The centers of these bolts are hollow to provide for lead wool, which is used in the final balancing of the propeller. These bolts also support the spinner bulkhead. After balancing, each bolt head is sealed with a welch plug. The propeller is located on the propeller shaft by two cones. The steel front cone is in two sections that are serially numbered and must be used as a pair. A ledge on the cone fits over the base of the piston at installation, holding that part in place, and a groove is provided below this ledge for the neoprene front cone packing washer that establishes the oil seal between the propeller piston and the shaft. The bronze rear cone has a single split that allows it to be easily fitted over the propeller shaft, yet fit closely to the shaft when the propeller is installed. The hub snap ring is a split steel ring that is inserted into a groove in the outboard end of the spider bore. Another steel ring (the front cone spacer) fits between the hub snap ring and the front cone, and takes up the clearance between these parts. The piston is fixed to the propeller shaft by means of a vernier lock ring that is "L" shaped in cross section. The inner diameter incorporates notches that match and fit over the octagon section of the piston. To lock the piston in place, cotter pins are inserted through holes in the vertical section of the lock ring and into matching holes in the spider.

4-250. PROPELLER SPINNER.

4-251. A streamlined fairing spinner assembly, consisting of two bulkhead halves and a front and rear section, is assembled on the propeller hub. Each bulkhead half is secured to the hub by means of two barrel bolts. The adapter halves are balanced and are interchangeable. The spinner rear and front sections are assembled on the two bulkhead halves by means of 24 attaching screws. These screws are safetied in pairs, a front and a rear section screw head being safetied together. To facilitate lubrication of the counterweights and spider, four holes have been incorporated in the spinner front section for access to the grease fittings. These holes are faired with rubber plugs.

4-252. PROPELLER GOVERNOR.

4-253. A single-acting, engine-driven, flyball-type propeller governor (Model 1M12) is mounted on top of the engine front accessory section to maintain constant engine speed by automatically varying the pitch of the propeller blades. The propeller governor consists essentially of the following parts: a gear-type booster pump that takes oil from the engine lubricating system and boosts it to the pressure required to operate the propeller pitch changing mechanisms; a pilot valve, actuated by spring-balanced flyweights, that controls the flow of oil to and from the propeller; a speeder-spring adjusting rack that varies the compression on the speeder spring, thus changing the speed at which the flyweights must rotate for the on-speed condition; and an oil pressure relief valve system that limits pressure of the gear-type pump, yet allows it to provide sufficient operating force to control the propeller blade angle under all conditions. Manual control of the propeller blade angle during engine operation is by means of the governor, which is connected mechanically through a rod and lever linkage to both cockpits. A high rpm adjusting screw, located on the governor head, limits travel of the governor control arm. Turning the adjusting screw clockwise decreases high rpm, and turning the screw counterclockwise increases high rpm. One complete turn of the adjusting screw will result in an adjustment of 20-25 rpm. A locknut on the screw maintains the adjustment.

4-254. REMOVING PROPELLER GOVERNOR. To remove a propeller governor, make sure ignition switch is "OFF"; then proceed as follows:

WARNING

Before moving propeller, be sure ignition lead plug is connected to receptacle at firewall. If ignition ground lead plug is not grounded, the ignition system of the airplane is operative the same as though the ignition switch were "ON," and the engine may fire if the propeller is moved.

a. Disconnect governor control linkage at arm on governor head.

b. Remove four self-locking nuts that secure governor base to governor mounting pad, and lift governor from its seat.

c. Remove governor mounting gasket, and install cover on governor base.

d. If governor is not to be reinstalled on airplane, remove governor control arm.

4-255. INSTALLING PROPELLER GOVERNOR. Before installing a propeller governor, check the governor for freedom of movement; also check cockpit controls to make sure there is no binding and that full travel of the control lever is available. To install a governor, proceed as follows:

a. Make sure ignition switch is "OFF."

WARNING

Before moving propeller, be sure ignition lead plug is connected to receptacle at firewall. If ignition ground lead plug is not grounded, the ignition system of the airplane is operative the same as though the ignition switch were "ON," and the engine may fire if the propeller is moved.

b. Remove cover and gasket from governor mounting pad.

c. Install correct governor mounting gasket in position with raised portion of brass screen facing upward into governor base.

NOTE

Check holes in governor mounting gasket, and make sure none are plugged and that no holes in governor mounting pad on engine are covered or plugged when gasket is installed.

d. Place governor on pad, being careful that governor drive coupling splines enter properly into engine-governor drive shaft internal splines.

NOTE

Should splines not align properly, it is possible to force engine-governor drive shaft out of position as governor is installed. With the governor all the way down on the studs, the circular pilot boss should fit into the recess of the pad.

e. With governor in position, install one washer and a nut (Stock No. AF6500-513295-34, Part No. 46A1135-524) on each mounting stud. Install all four nuts before attempting to draw any of them down, as the upper flange of the governor base will interfere if the governor is resting on the pad. Tighten the self-locking nuts down snugly and evenly, to 100 to 140 inch-pounds torque.

f. Install governor control arm, and connect and adjust control linkage. (See figure 4-29.)

4-256. PROPELLER CONTROL SYSTEM

4-257. Refer to paragraph 4-231.

4-258. STARTER SYSTEM.

4-259. The starting system (figure 4-49) comprises the following units: inertia-type starter, starter switch, starter relay, and induction vibrator. Although the induction vibrator does not contribute anything toward actual starter operation, it does assist the engine magneto in supplying a hotter spark to the plugs during the starting period. The starter system can be operated electrically (remotely) or mechanically (hand-crank). The latter operation is usually accomplished as an emergency method.

4-259A. STARTER SYSTEM OPERATION.

4-259B. With external power connected to airplane (battery of airplane for emergency use only), depressing the foot-operated starter switch to either the "ENERGIZE" or "ENGAGE" position will rotate the direct-cranking starter and simultaneously energize the induction vibrator. Direct cranking will continue as long as the foot-operated starter switch is depressed. Manual starting (hand-cranking) is accomplished by removing the starter hand-crank from its stowed position in the baggage compartment and inserting it into the crankshaft on upper left side of the engine cowling. Two men are required to crank the inertia flywheel to the required 15,000 rpm or 12-second cranking period. For full manual start, the starter is engaged when the ring adjacent to the starter crank is pulled.

4-260. TROUBLE SHOOTING STARTER SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Starter motor operates, but starter fails to crank engine.	Leakage of oil into starter.	Replace starter.
	Clutch not properly set.	Replace starter.
	Worn or scored clutch disks.	Replace starter.
	Starter rotation incorrect.	Replace starter.
	Meshing solenoid not operating.	Test the solenoid coil for open or grounded circuit. Replace the solenoid, if necessary.

TROUBLE	PROBABLE CAUSE	REMEDY
	Binding or broken engaging linkage.	Repair linkage.
	Broken gearing.	Replace starter.
Motor fails to operate or operates at too low a speed.	Low voltage due to discharged battery.	Check and recharge battery.
	Loose, dirty, or improper external connections.	Tighten, clean, or connect external connections properly.
	Starter control switch not operating.	Check, and replace if necessary.
	Binding, worn, or improperly seated brushes.	Service the brushes.
	Dirty commutator.	Clean the commutator.
	Rough, pitted, or scored commutator.	Replace starter.
	Commutator not concentric.	Replace starter.
	Shorted, grounded, or open armature.	Replace starter.
	Grounded or open field.	Replace starter.
	Defective solenoid starting relay.	Replace solenoid.
	Worn, rough turning, or improperly lubricated ball bearings.	Replace starter.
Handcranking difficult or impossible. (Brush springs in the "OFF" position.)	Misalignment of handcrank extension.	Check for misalignment, and correct if necessary.
	Starter jaw remaining in engagement with engine jaw.	Disengage the starter jaw.
	Leakage of engine oil in starter.	Replace starter.
	Improper lubrication of starter.	Replace starter.
	Worn starter bearings and gears.	Replace starter.
	Improper clearances in starter and motor.	Replace starter.
Acceleration time too high.	Low voltage due to discharged battery.	Check and recharge the battery.
	Loose or dirty external electrical connections.	Clean and tighten the connections.
	Binding, worn, or improperly seated brushes.	Service the brushes.
	Dirty commutator.	Clean the commutator.
	Rough, pitted, or scored commutator.	Replace starter.

TROUBLE	PROBABLE CAUSE	REMEDY
	Commutator not concentric.	Replace starter.
	Shorted, grounded, or open armature.	Replace starter.
	Grounded or open field.	Replace starter.
	Worn, rough turning, or improperly lubricated ball bearings.	Replace starter.
	Leakage of engine oil into starter.	Replace starter.
	Misalignment of handcrank extension.	Check, and correct if necessary.
	Starter jaw remaining in engagement with engine jaw.	Disengage the starter jaw.
	Improper lubrication of starter.	Replace starter.
	Worn starter bearings and gears.	Replace starter.
Excessive wear and arcing brushes.	Binding, worn, or improperly seated brushes.	Replace starter.
	Dirty commutator.	Clean the commutator.
	Rough, pitted, or scored commutator.	Replace starter.
	Commutator not concentric.	Replace starter.
	Shorted, grounded, or open armature.	Replace starter.
	Grounded or open field.	Replace starter.
	Brush spring tension too high.	Readjust or replace the brush springs.
INDUCTION VIBRATOR		
Unit fails to function.	Unit not grounded.	Clean mounting bolt surfaces, and remount unit so that clean surfaces make good contact to ground.
	Loose or disconnected positive cable.	Tighten, or reconnect and tighten, positive cable connection.
	Loose or disconnected "MAG" or "IGN-SW" terminals.	Reconnect and tighten "MAG" or "IGN-SW" terminals.

NOTE

If remedies listed do not correct the trouble, entire vibrator unit must be replaced. Do not attempt to make any adjustments while unit is installed. Vibrator units in need of repair should be returned to maintenance section equipped to conduct disassembly, inspection, repair, and reassembly.

4-261. STARTER.

4-262. A Type G-5, 24-volt inertia starter is mounted on the center of the engine accessory case. The motor is a four-pole, series-wound unit utilizing four brushes, two of which are grounded to the motor housing. A removable window strap covers the four windows provided to facilitate inspection and replacement of the motor brushes. A meshing solenoid, which is part of the starter, is mounted on an insulating board attached to the side of the motor housing. This solenoid and the starter flywheel can be operated either electrically or mechanically. (Refer to paragraph 4-259.)

4-263. REMOVING STARTER. Remove starter in the following manner:

a. Remove the lower and two side engine accessory cowlings.

b. Remove cable from engaging solenoid.

c. Disconnect handcrank extension tube from starter.

d. Disconnect the two wires from starter studs.

e. With an extra man supporting the starter, remove the mounting nuts.

f. Carefully remove starter from engine.

4-264. INSTALLING STARTER. To install starter, proceed as follows:

a. Remove the lower and two engine side accessory cowlings.

b. Install gasket on starter engine pad.

NOTE

Be sure the paint has been scraped from the back of the mounting flange around three of the mounting holes so there will be a good ground connection between starter and the engine.

c. Position starter correctly on pad so that engaging cable and handcrank extension tube fit to starter. Tighten mounting nuts.

d. Connect manual engaging cable to starter engaging solenoid.

e. Connect handcrank extension tube to starter.

f. Connect two wires to the starter terminals (K5B6 to large terminal and K4D18 to small terminal).

g. Install cowling.

4-265. REPLACING STARTER BRUSHES. If brushes have reached a brush length of 5/16 inch, replace them in the following manner:

NOTE

Brushes can be replaced while starter is installed on airplane; however, brushes would be more easily accessible if starter were removed from engine.

a. Remove window strap assembly.

b. Disconnect all brush leads.

c. Lift brush springs, and remove brushes.

d. Lift brush springs, and insert new brushes.

NOTE

Observe that new brushes fully contact the commutator face. If they do not, remove starter from engine and set it up on a bench motor test assembly. Run in brushes under load until brush is 50% seated, then 100% seated on a free run test.

e. Reconnect brush leads terminals, making certain not to twist the leads. Be sure brush lead sleeving is not burned or frayed, and that all connections are clean and tight.

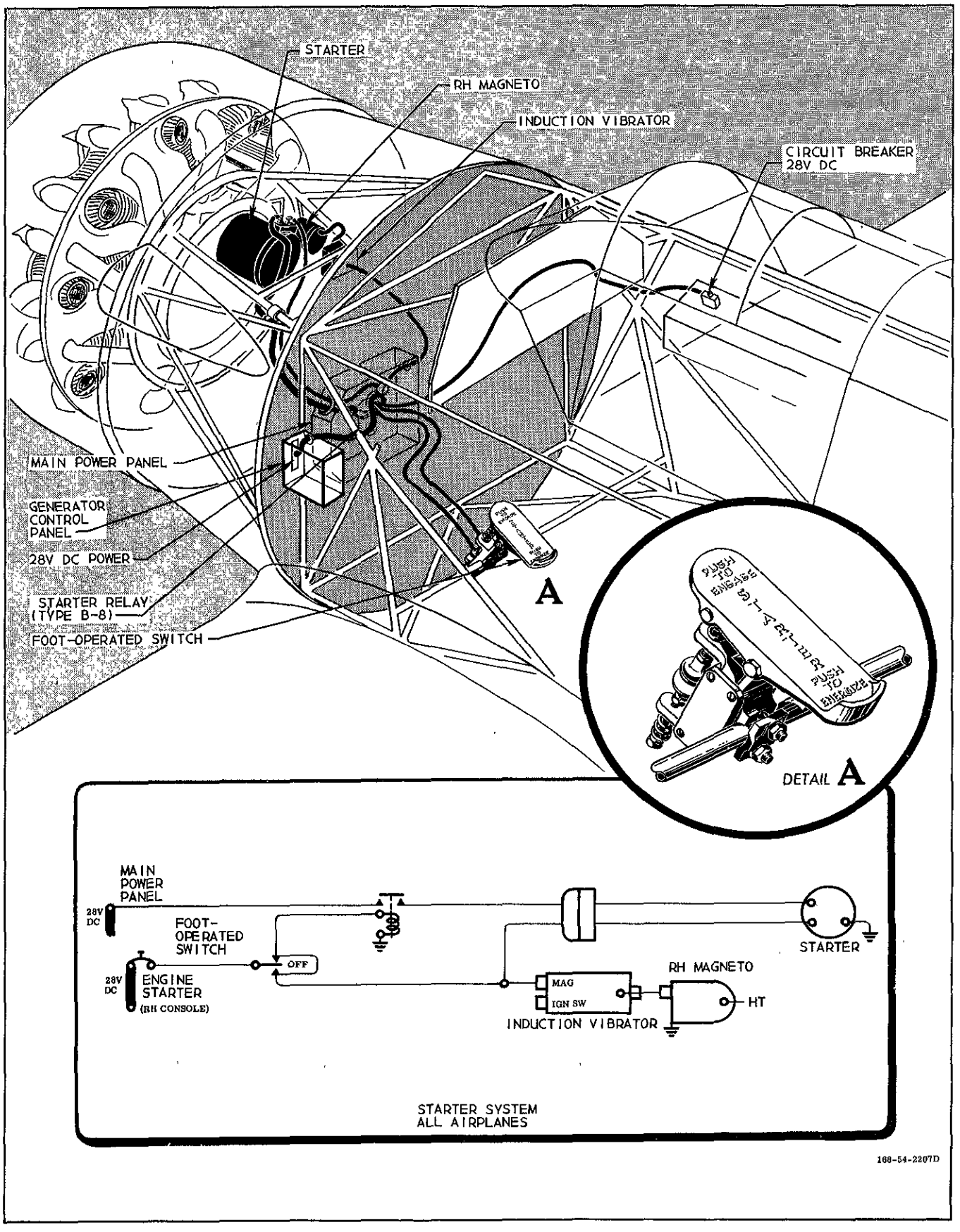


Figure 4-49. Starter System Schematic

f. Install window strap assembly.

4-266. TESTING BRUSH SPRING TENSION. Test for brush spring tension in the following manner, assuming that brush spring release is in "ON" position, thus allowing brushes to contact commutator:

a. Remove window strap assembly.

b. Place spring scale under portion of spring that normally rests on top of brush. Lift spring to a height of 1/8 inch above the brush box. The scale must read between 24 and 28 ounces for all springs. If one or more springs do not meet the tolerance, send starter to depot for readjustment or replacement of spring or springs.

c. After test is made, remove scale, and install window strap assembly.

4-267. CLEANING COMMUTATOR. If the commutator has a dirty appearance and is not rough, pitted, or discolored, clean in the following manner:

a. Remove window strap.

b. Remove brushes. (Refer to paragraph 4-265.)

c. Clean commutator with a clean cloth moistened in unleaded gasoline or suitable solvent.

CAUTION

Do not use carbon tetrachloride to clean the parts because its use will result in rapid brush wear, excessive sparking at the commutator, and corrosion of other parts.

d. Install brushes, making sure each brush is inserted into same brush box from which it was taken.

e. Install window strap.

4-267A. INDUCTION VIBRATOR COIL.

4-267B. The induction vibrator coil (VJR24B-5X), located on the oil tank forward support tube, is installed for the purpose of providing additional ignition to obtain an easy engine start. When the foot-operated starter switch is placed in the "ENGAGED" position, the induction vibrator is energized and produces rapidly interrupted current. This current is fed directly to the right-hand magneto, which produces and distributes high-tension current to the front spark plugs of the engine. After the engine starts, the foot-operated starter switch is released from the "ENGAGED" position, causing the induction vibrator to become de-energized and thereby restoring the ignition system to normal operation. The induction vibrator and starter circuits are protected by a 15-ampere push-pull circuit breaker on the right forward console.

CAUTION

Extreme caution must be taken to stay clear of propeller when induction vibrator terminals marked "IGN-SW" or "MAG" are disconnected from ignition system, because removal of these terminals opens the grounding circuit, causing the magnetos to become operative. Similar caution must be exercised if ignition wiring is disconnected at firewall receptacle.

4-267C. REMOVING INDUCTION VIBRATOR COIL. Remove induction vibrator coil in the following manner:

a. Cut safety wiring on induction vibrator terminals "IGN-SW" and "MAG"; then disconnect terminal, from induction vibrator.

b. Remove induction vibrator cover and disconnect "+" (plus) lead from terminal.

c. Remove induction vibrator from oil tank support tube.

4-267D. INSTALLING INDUCTION VIBRATOR COIL. Install induction vibrator coil in the following manner:

a. Position induction vibrator on oil tank forward support tube and secure in place.

b. Connect "+" (plus) lead to terminal inside vibrator and replace vibrator cover.

c. Connect "IGN-SW" and "MAG" terminals, and safety-wire terminals.

4-268. IGNITION SYSTEM.

4-269. The ignition system (figure 4-50) consists of two four-pole type magnetos, a remote-controlled ignition switch, an induction vibrator, shielded ignition harness, and 18 spark plugs. The system provides dual ignition, and is controlled by the ignition switch operable from either cockpit by a remote-control torque-rod system. The system is completely independent of the electrical system of the airplane, except for the induction vibrator circuit, which is connected to the electrical bus through the starter circuit. For ease of starting, high-tension voltage is supplied by the induction vibrator through the right magneto.

4-270. TROUBLE SHOOTING IGNITION SYSTEM.

4-271. Refer to paragraph 4-158.

4-272. MAGNETOS.

4-273. Two magnetos (Bendix-Scintilla SB-9R) are mounted on the rear of the engine, one on each side of the starter. The magnetos are of the four-pole type, providing dual ignition to the spark plugs. The magnetos are driven counterclockwise at a speed ratio of 1.125:1 to engine crankshaft speed. The right magneto fires the front spark plugs, and the left magneto fires the rear spark plugs. Both magnetos are timed to fire at 25 degrees before top dead center of the No. 1 cylinder.

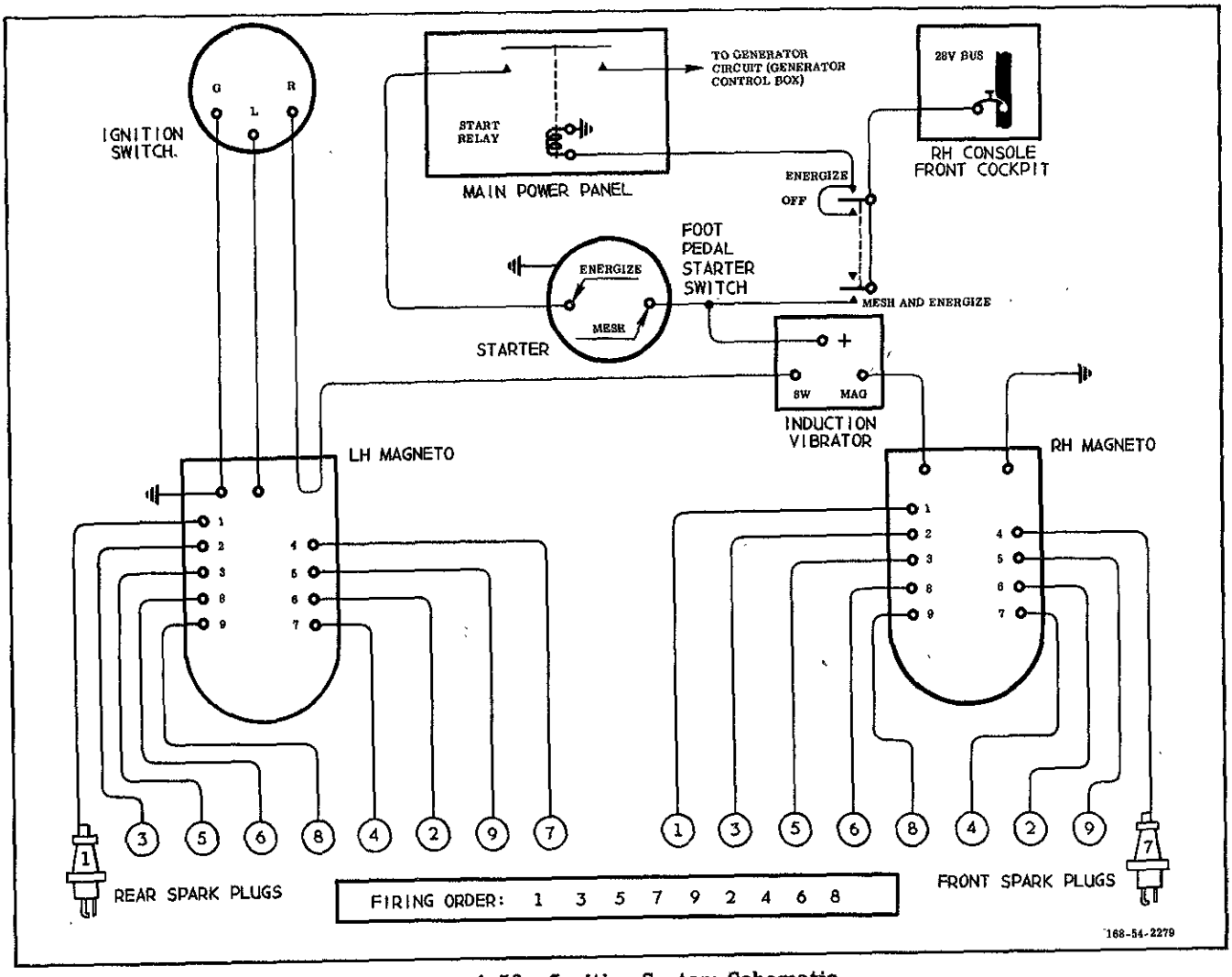


Figure 4-50. Ignition System Schematic

4-274. REMOVING MAGNETO. To remove magneto, proceed as follows:

a. Remove all accessory section cowling.

b. Loosen air blast tube clamp, and turn tube away from magneto.

c. Remove bolts and screws securing magneto shields to magneto; then remove shields.

d. Remove the breaker cover, and safety the breaker points by placing a piece of unwaxed paper between points. Replace breaker covers.

e. Remove magneto distributor blocks, and wrap in heavy clean paper.

f. Unscrew cap screws that secure magneto to the rear case, and lift magneto with its rubber coupling.

4-275. INSTALLING AND TIMING MAGNETO. To install and time magneto, proceed as follows:

a. Fit timing pointer (PWA-115) over the propeller shaft. Turn crankshaft counterclockwise until No. 1 cylinder piston is on compression stroke (both valves closed) and the timing pointer aligns with 25-degree mark on engine nose section.

b. Turn magneto shaft until timing marks on large distributor gear align with timing marks on the inside of the magneto front end plate. (See figure 4-51.) At this time, the distributor rotor should be opposite the No. 1 distributor block electrode and the breaker contact should just be opening.

c. Connect timing light across the magneto breaker contacts, or insert a .0015-inch feeler gage between the breaker contacts.

d. Turn magneto shaft slowly until breaker contacts begin to open. At this point, the timing light will go out, or the feeler gage can be pulled from between the contacts with slight pull. This should occur when a straightedge against the cam step (figure 4-51) is aligned with timing marks on breaker housing within 1/32 inch.

e. If straightedge does not align with timing marks,

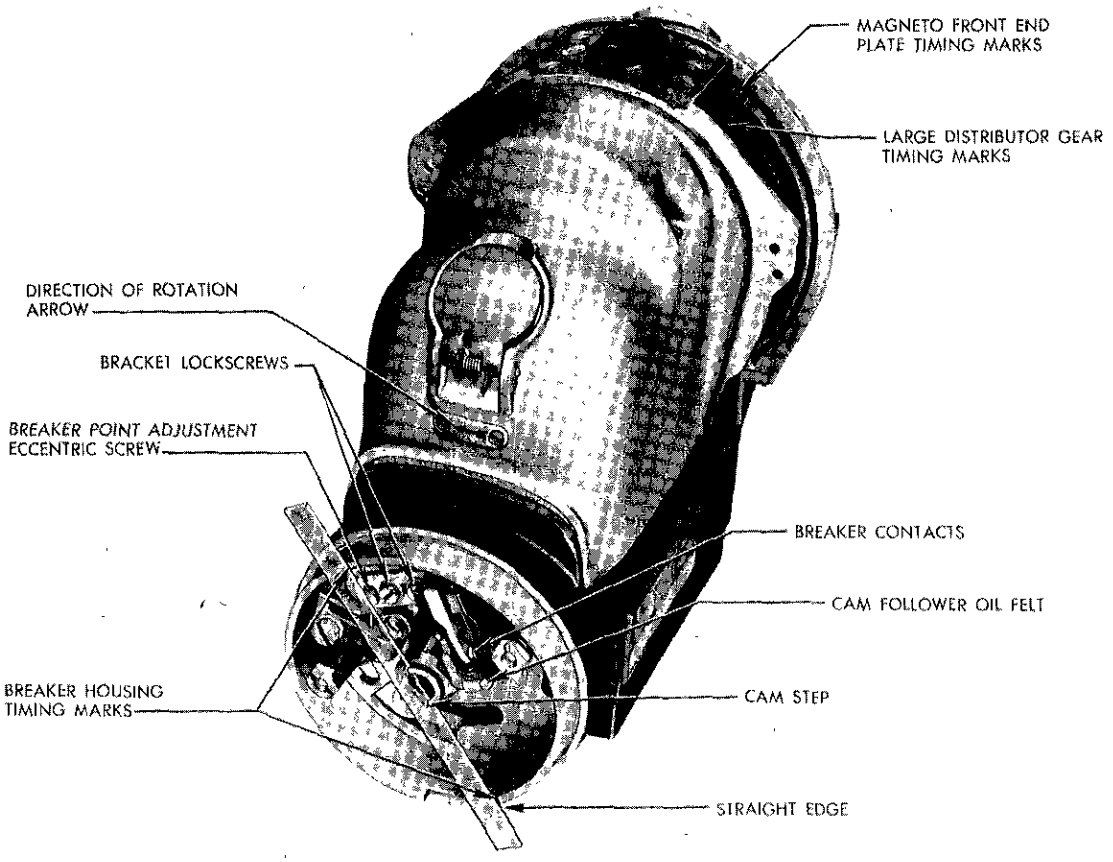


Figure 4-51. Timing Ignition

loosen bracket lockscrews, and adjust breaker points by turning eccentric screw until contact points just begin to open when straightedge placed against cam step coincides with timing marks or light goes out. Tighten bracket lockscrews. (See figure 4-51.)

f. Turn magneto drive rubber coupling until it can be engaged to its mating flanges without turning magneto drive shaft. Put rubber coupling in place; fit magneto over dowel pins on mounting pad, and secure magneto with cap screws and washers.

g. Repeat steps a. through f. to install other magneto.

h. When both magnetos have been installed, turn engine crankshaft 90 degrees in normal direction of rotation (clockwise as viewed from rear of engine). Slowly reverse the rotation until feeler gage can be moved from between contact points with a slight pull or the timing light goes out. Note position of timing pointer on propeller shaft. Contact points of both magnetos should open simultaneously when timing pointer is aligned with the 25-degree before top center mark on engine nose.

i. If contact points open before pointer aligns with the 25-degree mark, remove magneto; then turn rubber coupling clockwise one or two notches. Reinstall magneto and check timing (step h.).

j. If contact points open after pointer aligns with timing mark, rotate rubber coupling counterclockwise and check timing (step h.).

NOTE

The rubber coupling has 19 notches on one side and 20 notches on other side. This feature provides a vernier-type adjustment, making very fine adjustments possible.

k. Make a final check to make sure that a straightedge will align with cam step and breaker housing timing marks when breaker points are just opening.

l. Install distributor blocks in their correct position.

m. Install magneto shields over blocks, and fasten shields with nuts and pins.

n. Install breaker cover, and secure cover with knurled screws. Safety screws with wire clips.

o. Align and secure magneto air blast tubes in place.

4-276. SPARK PLUGS.

4-277. The engine is equipped with 18 spark plugs (RC26S, 706SR, or SH2K), two per cylinder. The front spark plugs receive their spark from the right magneto, and the rear spark plugs are fired by the left magneto. The spark plug operating gap is .015 to .018 inch.

4-278. REMOVING SPARK PLUGS. To remove a spark plug, proceed as follows:

a. If removing a rear spark plug, remove nose ring cowl. (Access to the front spark plugs is obtained from front of engine, and engine nose ring cowl need not be removed.)

b. Disconnect lead at spark plug; then carefully withdraw phenolic or porcelain connector from spark plug, being careful that wire tip does not scrape on spark plug barrel. Install suitable protector cap over connector.

c. Remove spark plug and washer from cylinder head boss.

4-279. INSTALLING SPARK PLUGS. To install a spark plug, proceed as follows:

NOTE

All spark plugs installed on any one engine must be of the same type regardless of the number of approved types.

a. Examine spark plug to ascertain that it is of the approved type and in serviceable condition. Check for proper operating gap of .015 to .018 inch.

b. Install new or serviceable copper gasket on plug; then lightly lubricate the first two spark plug threads with antiseize compound (Specification No. MIL-C-5544).

CAUTION

Make sure no lubricant is accidentally applied on electrodes, as flashover on starting will result.

c. Insert spark plug into cylinder bushing; then, using fingers, screw in plug until gasket is seated.

d. Tighten plug to a torque of 300 to 360 inch-pounds.

e. Make sure that inside of spark plug barrel is clean and dry. Wipe spark plug connector clean; then, with a clean brush, apply a thin coating of insulating compound (Specification No. AN-C-128) to connector. Fill area of contact spring with compound. Do not apply any compound in spark plug barrel.

f. Insert lead connector in spark plug barrel and, using fingers, thread lead nut onto spark plug until snug; then, using wrench, tighten nut only until lead elbow begins to turn.

4-280. ENGINE OIL SYSTEM.

4-281. The oil system (figure 4-52) is of the dry-sump, pressure type, and consists of an oil tank, gear-type pressure and scavenge pump, pressure relief valve, oil screen, oil cooler, oil temperature regulator, surge valve, and necessary lines. An oil temperature and oil pressure indicating system, and an oil dilution system also are provided.

4-282. OIL SYSTEM OPERATION.

4-283. Oil from the supply tank is routed by gravity feed and pump suction through a "Y" drain valve to the pressure pump mounted on the lower right side of the accessory gear case. The engine pump forces the oil through a cored passage to the screen chamber. After entering the screened chamber, the oil passes through the screen and then through a spring-loaded check valve. (When the engine is not running, the check valve prevents oil from seeping into or out of the engine.) From the check valve, the oil is routed to all parts requiring lubrication, and then to the main sump, where it is pumped through the scavenge pump to the tank or oil cooler, depending on the oil temperature or oil pressure. Oil from the scavenge pumps is routed to the surge valve, which directs the oil either to the thermostatic valve on the oil cooler, or back to the tank. If a maximum pressure is reached because of oil congealing in the cooler, the surge valve routes the oil directly to the tank. The thermostatic valve directs oil, when cold, to pass through the outside jacket of the oil cooler or, when hot, to flow through the radiator. The oil then flows back to the hopper in the oil tank for deaeration, then to the tank outlet to start another cycle.

4-284. TROUBLE SHOOTING ENGINE OIL SYSTEM. Refer to paragraph 4-158 for trouble shooting chart.

4-285. OIL TANK.

4-286. The aluminum alloy engine oil tank (figure 4-52) is attached to the engine mount crossbar and tank support tube by means of support straps connected by turnbuckles. The circulating system, incorporated in the tank, accelerates warming of oil during engine run-up and assists in removing air from the oil. Oil flows into the hopper at a tangent, and spirals down to the bottom. Centrifugal action aids in separating air from the oil. The tank is vented by two lines into the accessory gear case of the engine. The engine gear case is vented to atmosphere.

4-287. OIL COOLER ASSEMBLY.

4-288. The oil cooler assembly consists of Type C-5 oil cooler and a Type D-5 oil temperature regulating valve. Cooling air for the oil cooler is furnished by means of a scoop that forms the lower portion of the engine compartment cowling. The automatic temperature regulating valve allows oil, when cold, to pass through the outside jacket and to the tank and, when hot, to flow through the radiator to the tank.

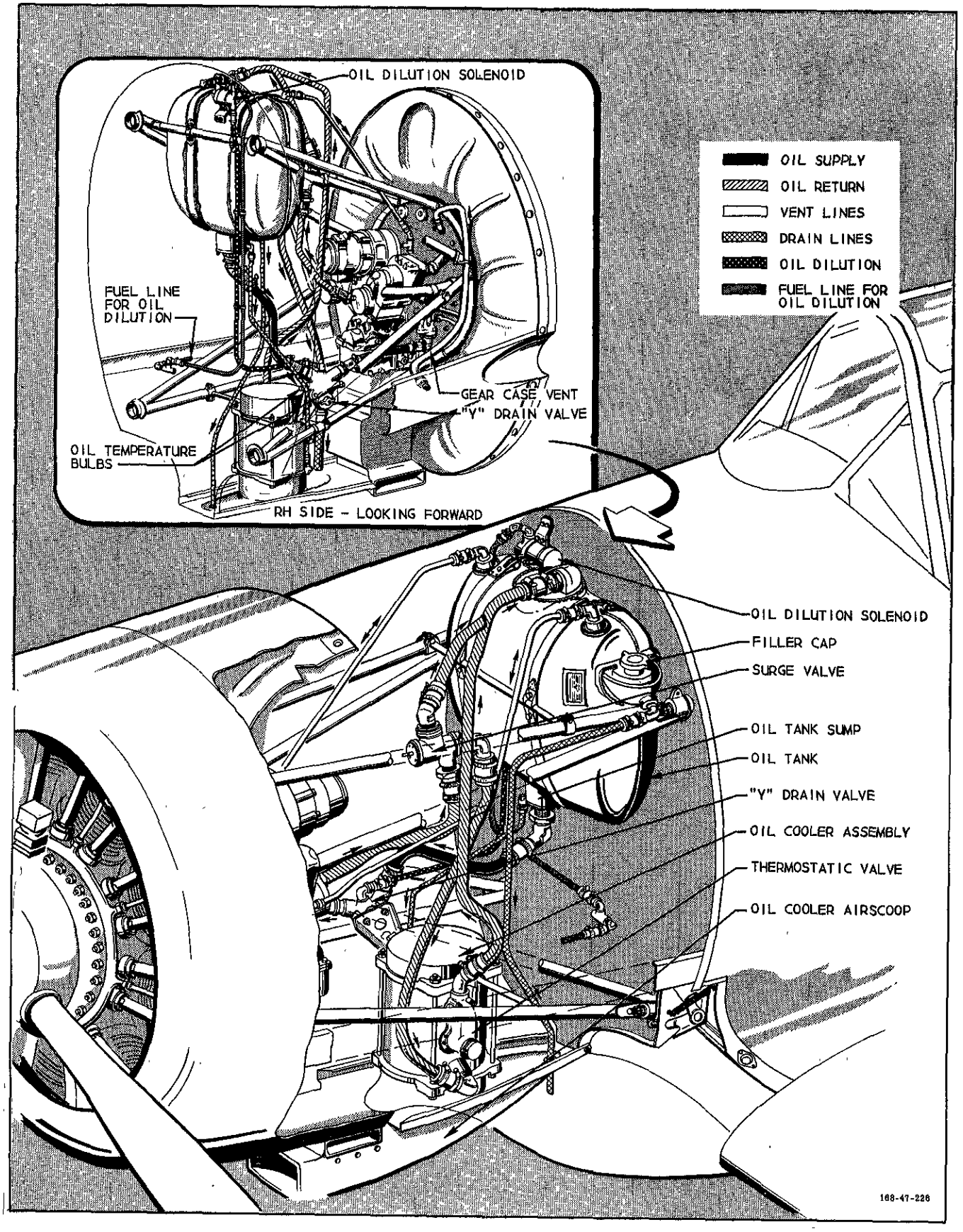


Figure 4-52. Oil System

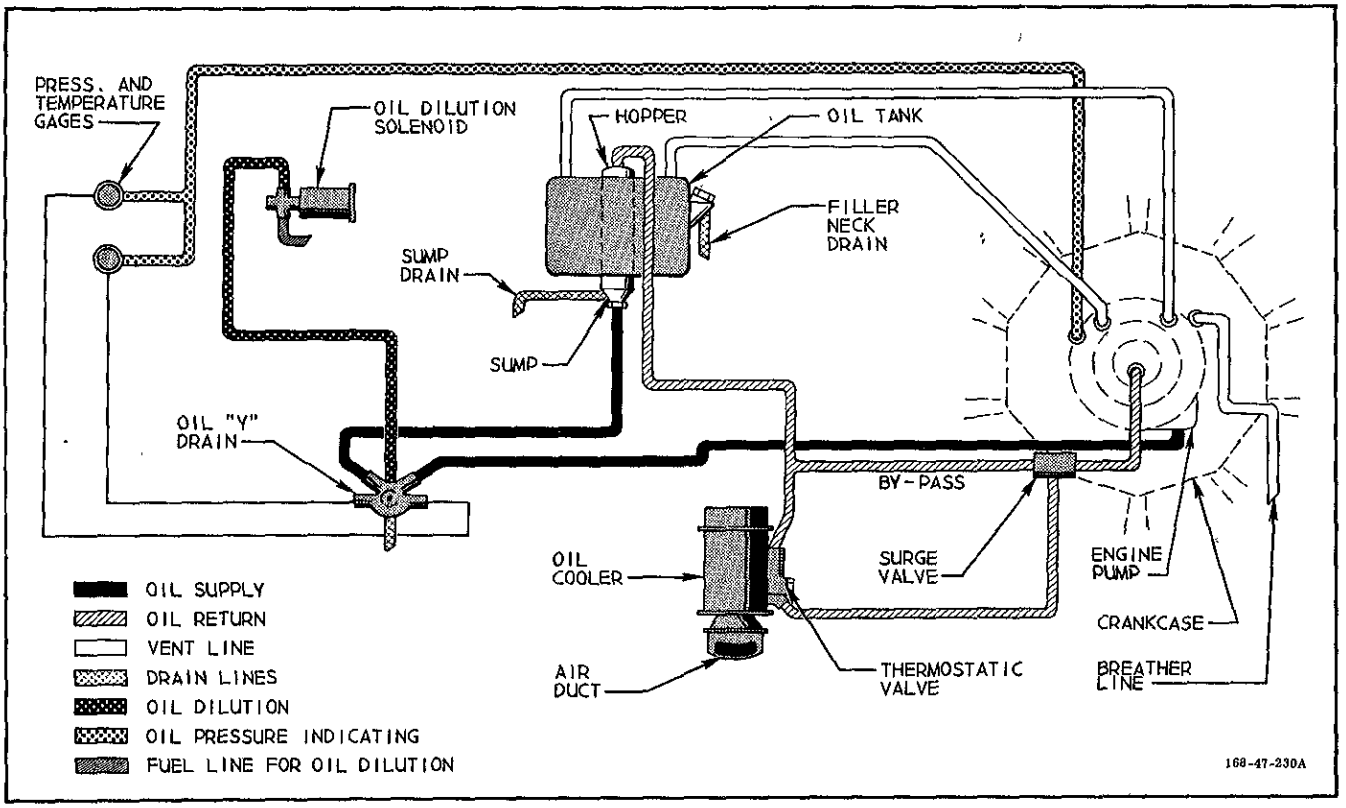


Figure 4-53. Oil System Schematic

4-289. REMOVING OIL COOLER. To remove the oil cooler, proceed as follows:

a. Remove bottom sections of engine compartment cowling.

b. Drain the oil system.

c. Remove the oil cooler air scoop.

d. Disconnect surge valve-to-cooler line and the cooler-to-tank line at the cooler.

e. Disconnect the cooler support links between the cooler support and the air mixing chamber.

f. Support the oil cooler, and remove the two bolts securing the cooler to the support tube (between lower engine mount braces).

4-290. INSTALLING OIL COOLER. To install the oil cooler, proceed as follows:

a. Install oil cooler assembly onto support tube (between the lower engine mount braces).

b. Connect the cooler support links between the cooler and the air mixing chamber.

c. Connect the surge valve-to-cooler line and the cooler-to-tank line.

d. Install the oil cooler air scoop.

e. Service the oil system. (Refer to paragraph 3-28 for servicing instructions.)

f. Install bottom sections of engine compartment cowling.

4-291. OIL SYSTEM SURGE VALVE.

4-292. A surge valve (United Aircraft Products UB-4400-1) is provided to protect the oil cooler from high oil pressure when the engine is started in cold weather. The valve is mounted on the top left engine mount brace in the line between the engine and oil cooler. A by-pass line connected to the valve joins the oil return line from the oil cooler to the tank. The valve has three ports: one for the oil return line from the engine to the valve; one for the oil return line leading from the valve to the regulator; and one connecting with the by-pass line. The by-pass port has a spring-actuated check valve set to open at 85 psi. When oil pressure induced by oil congealing in the cooler reaches 85 psi, the check valve opens and permits the flow of oil through the by-pass line into the tank. Meanwhile, the increasingly warm oil coming from the engine will gradually melt the oil in the cooler, permitting flow through it at pressures less than 85 psi. The check valve again closes and all return oil from the engine is routed through the oil cooler line to the tank.

4-293. OIL PRESSURE RELIEF VALVE.

4-294. The adjustable, spring and plunger-type oil pressure relief valve, located on the right side of

the accessory gear case, relieves excessive oil pressures back to the inlet side of the pump.

4-295. ADJUSTING OIL PRESSURE RELIEF VALVE. Adjustment of the engine oil pressure to the required 80 (±5) psi is accomplished by removing the cap on the oil pressure relief valve (located on the right side of the accessory gear case), loosening the locknut, and turning the adjusting screw. Clockwise turning increases the pressure; counterclockwise turning decreases it. The adjustment is made with the engine running at 2000 rpm with 60°C (140°F) engine inlet oil temperature.

4-296. OIL TEMPERATURE INDICATING SYSTEM.

4-297. The oil temperature indicating system consists of an oil temperature bulb (one for each cockpit) and an indicator located in the engine gage unit on the instrument panel of each cockpit. The instruments are in a modified Wheatstone bridge circuit with the bulbs acting as one leg of the bridge circuit. (For further information regarding the oil temperature bulb and indicator, refer to paragraph 4-459.)

4-298. OIL PRESSURE INDICATING SYSTEM.

4-299. The oil pressure indicating system consists of a pressure indicator in each cockpit, and lines connecting the indicators with the oil pressure connection located on the left side of the accessory gear case of the engine. (For further information regarding the oil pressure indicator, refer to paragraph 4-459.)

4-300. OIL DILUTION SYSTEM.

4-301. An oil dilution system is provided to admit small quantities of fuel into the oil system to reduce the viscosity of the oil in cold weather. An oil dilution solenoid valve is mounted on the firewall above the oil tank. This valve is connected in the fuel line from the fuel pressure indicating system connection to the oil "Y" drain valve, and is controlled by a switch on the front cockpit electrical control panel. When the switch is "ON," the solenoid valve unseats, allowing fuel pressure from the engine-driven pump through the valve into the "Y" drain valve and into the engine.

4-302. CHECKING OIL DILUTION SYSTEM. To check the oil dilution system for proper operation, proceed as follows:

a. Disconnect oil dilution line at the oil dilution solenoid valve.

b. Operate fuel hand-pump and check for fuel leakage from oil dilution line.

c. Operate oil dilution switch, and observe if steady fuel flow occurs from oil dilution line.

d. Connect oil dilution line at solenoid valve.

4-303. FUEL SYSTEM.

4-304. The fuel system (figure 4-54) consists of two removable metal tanks housed within the wing center section, two removable bladder-type cells installed in the root of each outer wing panel, a Type F-10 engine-driven fuel pump mounted on the engine accessory gear case, a fuel unit (combination hand-pump and strainer) on the forward side of the firewall, a fuel selector valve, and low-level warning system, and two float-type fuel quantity gages. Fuel flows by gravity from the outer wing tanks to the sump on the center wing tank. Fuel is inducted into the engine from either the right or left tanks by means of a fuel tank selector valve, through the combination fuel unit to the engine-driven pump and then into the carburetor. If the engine-driven pump fails, fuel is supplied to the carburetor by the fuel unit, with pressure being applied by the hand-pump, which can be operated from either cockpit. The system operates on 3 to 6 psi, governed by the relief valve in the Type D-3 fuel unit. Airplanes AF49-3538 through AF49-3596 have provisions for carrying a 55-gallon capacity auxiliary fuel tank. (Refer to paragraph 4-329B.)

4-305. TROUBLE SHOOTING FUEL SYSTEM.

4-306. Refer to paragraph 4-158.

4-307. FUEL TANKS.

4-308. Two types of fuel tanks are employed: two metal tanks, located in the wing center section; and two bladder-type tanks, one located in the root of each outer wing panel. The metal tanks are constructed of aluminum alloy, and consist of a top and bottom section welded together. The metal tanks are held in place by tank straps. Access to the fuel tanks for draining and inspection purposes is gained through several access doors on the lower face of the center section. Located in the bottom of the tank are sumps that incorporate the main fuel outlets, transfer fitting for transferring fuel from the outer wing fuel tanks, and drain fittings. A chamber located around the tank sump is equipped with flapper valves that allow fuel to enter the sump compartment, but restrict it from leaving when the airplane is maneuvering. The outer wing tanks are a bladder type, held in place in the bay by tabs and bungee cord and by tank fittings.

4-309. REMOVING CENTER WING TANKS. The parts referred to in the following procedure are identified in figure 4-55. To remove the center wing tanks, proceed as follows:

a. Drain fuel system. (Refer to paragraph 3-25.)

b. Place a padded support under the outer panel wing tips prior to removing fuel tank doors.

c. Remove fuel tank doors. First remove bolts securing door attaching angles to outer wing panel attaching angles; then remove screws and bolts securing doors to center section spars and bulkhead.

d. Remove cover plate from upper surface of wing center section, and disconnect fuel tank vent lines.

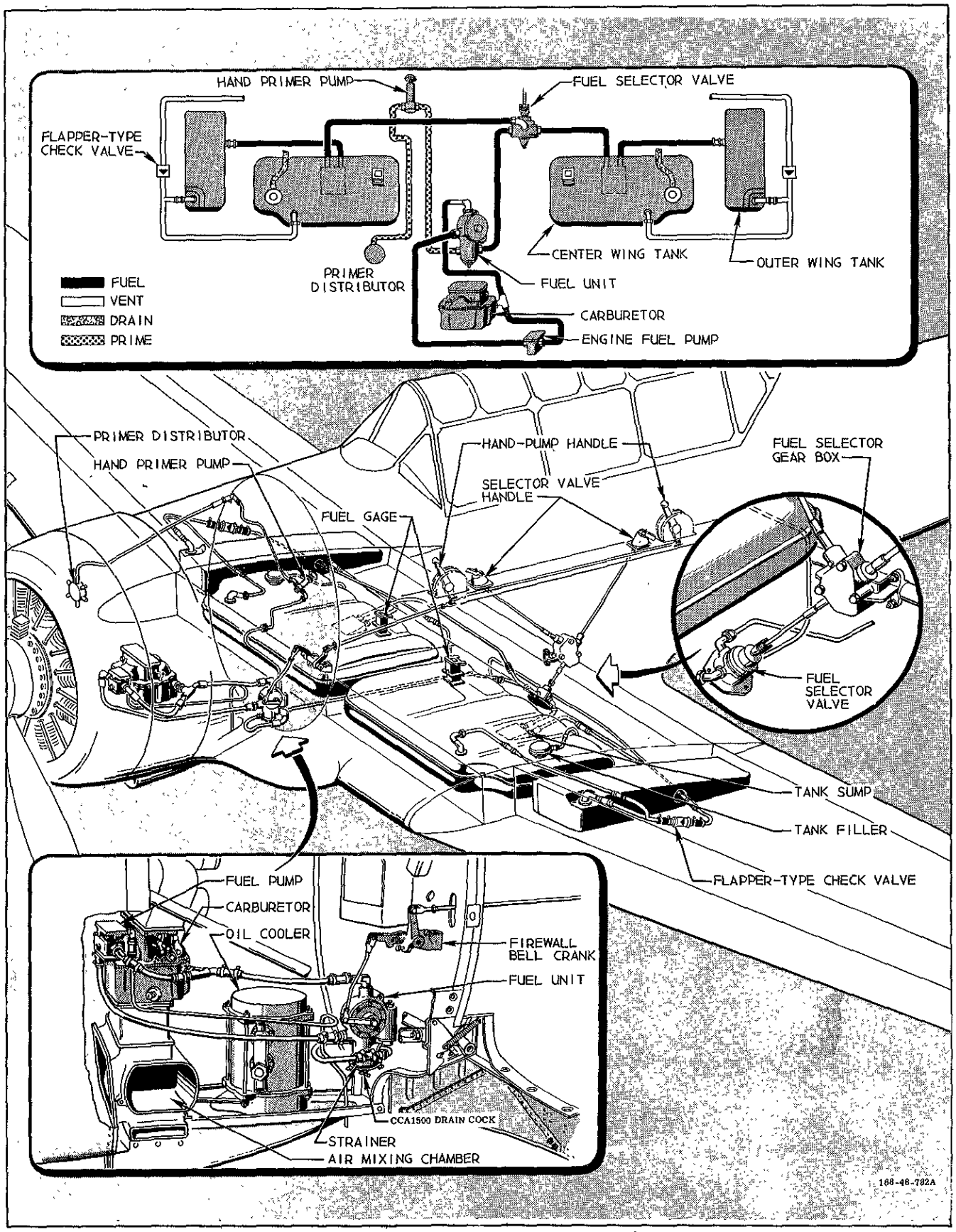
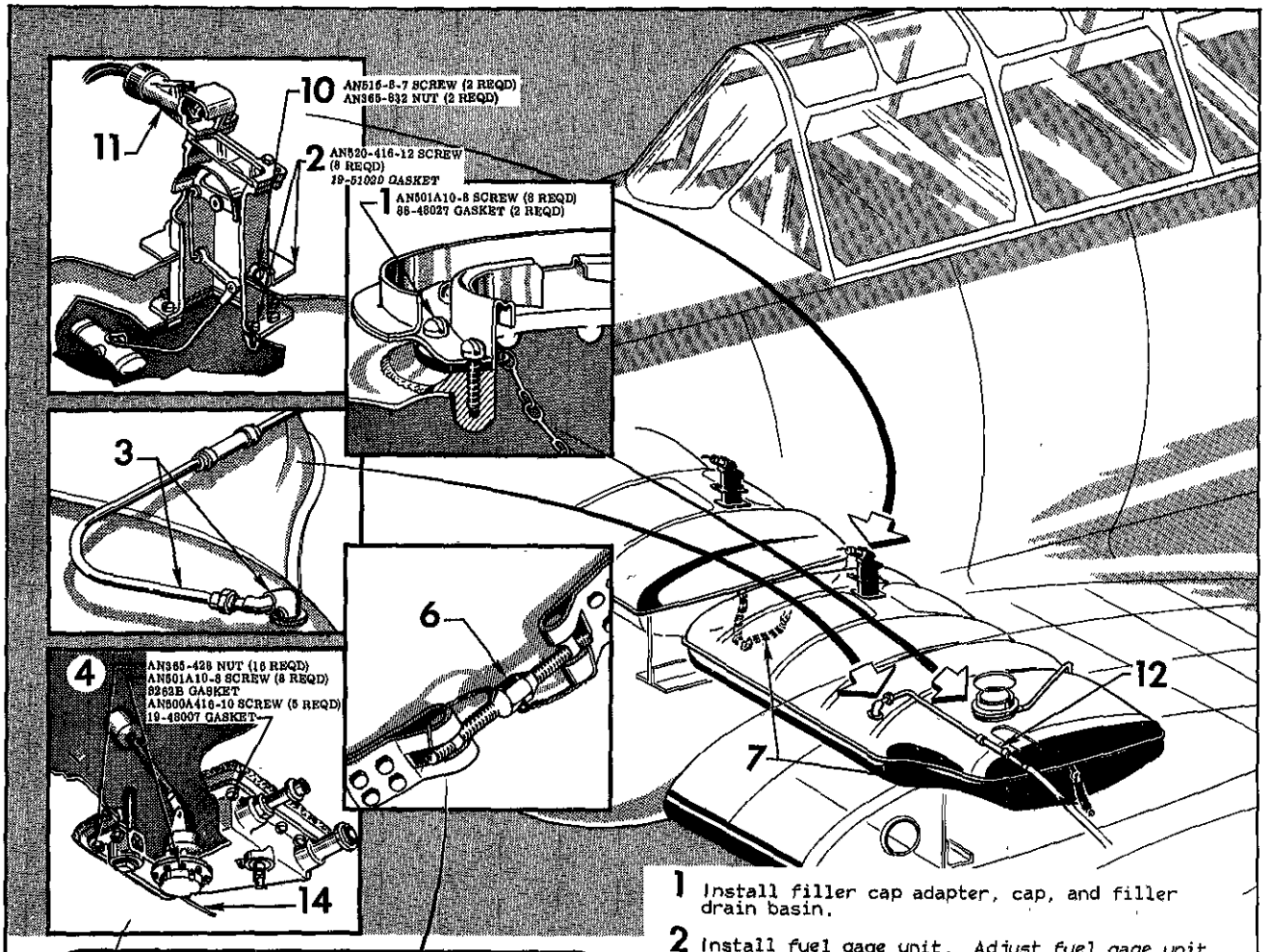
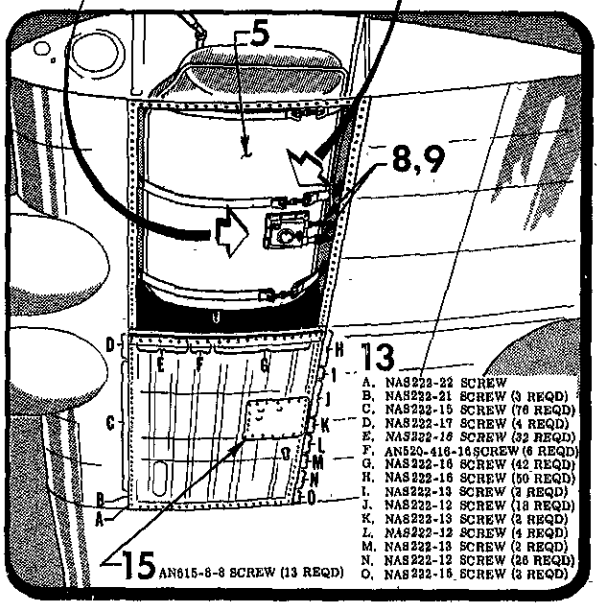


Figure 4-54. Fuel System





1 Install filler cap adapter, cap, and filler drain basin.

2 Install fuel gage unit. Adjust fuel gage unit by bending float arm as necessary to obtain complete fuel dial range indication. Be sure float is not cocked in vertical position at extreme ends of travel.

3 Install vent fitting elbow and vent line from elbow to connection in center section.

4 Install sump assembly, including transfer line fitting, outlet fitting drain valve, and float switch.

5 Lift tank into bay while guiding fuel gage through upper center section structure.

6 Secure tank in bay by securing turnbuckles.

7 Connect bonding braid.

8,9 Connect transfer and fuel outlet line.

10 Install cover plate around fuel gage.

11 Connect fuel gage light.

12 Connect vent line through access hole in upper surface of center section.

13 Install tank bay doors.

14 Connect float switch electrical wiring.

15 Install sump assembly access cover.

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Figure 4-55. Installing Center Wing Fuel Tanks

e. Remove light assembly from fuel gage, and the cover plates located around gage.

f. Disconnect bonding braids. Disconnect fuel lines at the sump.

g. Support tanks and disconnect support strap turnbuckles.

h. Guide fuel gage through upper surface of center section when lowering tanks from bays.

4-310. INSTALLING CENTER WING TANKS. See figure 4-55.

4-311. REMOVING OUTER WING TANKS. The parts referred to in the following procedure are identified in figure 4-56. To remove the outer wing tanks, proceed as follows:

a. Drain fuel system.

b. Remove wing outer panel. (Refer to paragraph 4-7.)

c. Remove drain valve, and disconnect drain fitting from wing structure.

d. Remove bungee support hangers (three on upper surface, and two on lower surface of tank).

e. Through access hole, disconnect vent line at hose connection.

f. Being careful not to damage vent line protruding from tunnel, lift tank from wing root.

4-312. ENGINE-DRIVEN FUEL PUMP.

4-313. The engine-driven fuel pump (Type F-10) is of the rotary positive-displacement type. The pump consists of a housing in which a rotor with four vanes is driven by means of a drive shaft incorporating a spline gear mating with a gear on the accessory drive section of the engine housing. The fuel pump is located on the lower left side of the accessory section, adjacent to the carburetor.

4-314. FUEL UNIT.

4-315. The Type D-3 fuel unit is installed on the lower forward side of the firewall. This unit consists of a hand fuel-pump, a fuel strainer, and a fuel pressure relief valve in one housing. The strainer is readily removed for cleaning, by removal of clamp securing strainer in housing.

CAUTION

When replacing fuel unit strainer, position strainer so that CAA 1500 drain cock is on inboard side of fuel unit (Type D-3) to preclude left wheel opening drain cock upon retracting.

4-316. FUEL PRESSURE RELIEF VALVE.

4-317. The balanced pressure relief valve, of the bellows type, is provided with a dashpot to dampen out flutter and high-frequency pulsations. Care should be taken to keep the vent hole free from obstructions.

4-318. ADJUSTING FUEL PRESSURE RELIEF VALVE. To adjust the fuel pressure relief valve, proceed as follows:

a. Remove lower left section of engine compartment cowling.

NOTE

Two men are required: one in the cockpit to observe the gage and run the engine, and one to make the adjustment.

b. Run engine at approximately 1800 rpm to check pressure.

c. Loosen locknut on adjusting screw.

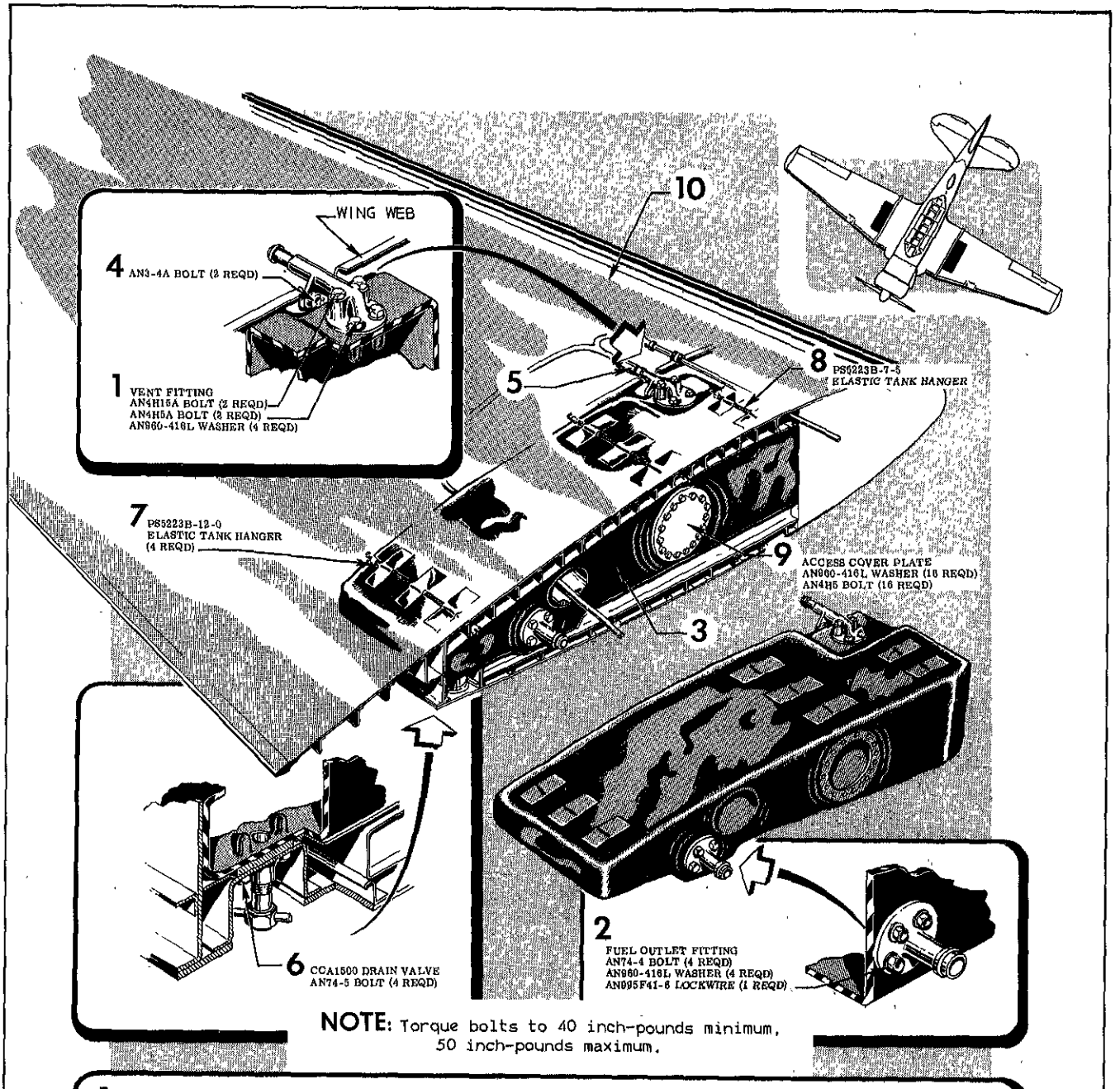
d. Turn pressure relief valve adjusting screw clockwise to increase fuel pressure and counterclockwise to decrease fuel pressure. Retard throttle while adjustment is being made; then run engine to 1800 rpm again to check results.

e. Tighten locknut when fuel pressure gage reads 3 to 6 psi. As tightening locknut may cause a change in pressure, run engine again to the proper rpm to check final result of adjustment.

4-319. HAND FUEL-PUMP.

4-320. The hand fuel-pump, being an integral part of the Type D-3 fuel unit, is installed on the lower forward side of the firewall. The handle for operating the hand fuel-pump is located on the control shelf at the left side of each cockpit. The control handles are interconnected by a rod and are connected to the hand-pump arm by means of a rod and bell crank. The function of the hand fuel-pump is to obtain fuel pressure when the engine is not running, and for emergency in the event of an engine pump failure.

4-321. ADJUSTING HAND FUEL-PUMP CONTROL LINKAGE. Adjustment of the hand fuel-pump firewall bell crank should be such as to prevent complete travel of the fuel-pump arm (approximately 3/16 inch) in either direction. To check for proper adjustment, place the cockpit control handles approximately 1/16 inch from their full forward position. With the handles in this position, the firewall bell crank adjustment bolt should be positioned against its stop. Remove the clevis bolt securing the control rod to the fuel pump handle, and make certain the pump handle is 1/8 inch into the control rod clevis. Move the cockpit handles to their full aft position, and check for the specified distance (1/16 inch) between maximum pump handle travel and the control rod clevis. If the travel of the pump handle is not restricted as specified before, reposition it on its spline shaft and adjust the stops on the firewall bell crank as required. It is desirable, if the linkage permits, to have the cockpit control handles fall 1/16 inch short of contact with their full forward stops when the firewall bell crank stop is engaged.



NOTE: Torque bolts to 40 inch-pounds minimum, 50 inch-pounds maximum.

1 Install vent fitting on tank.

2 Install fuel outlet fitting. (Fitting installation is completed by two additional bolts when wing is attached to center section.)

3 Install fuel tank in bay.

4 Secure vent fitting to wing structure.

5 Connect vent tube to tank fitting.

6 Secure drain fitting to structure and tank.

7,8 Install and secure tank hangers (five) to wing structure.

9 Install access cover plate.

10 Install wing assembly. (Refer to index for page number of applicable procedure.)

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Figure 4-56. Installing Outer Wing Fuel Tanks

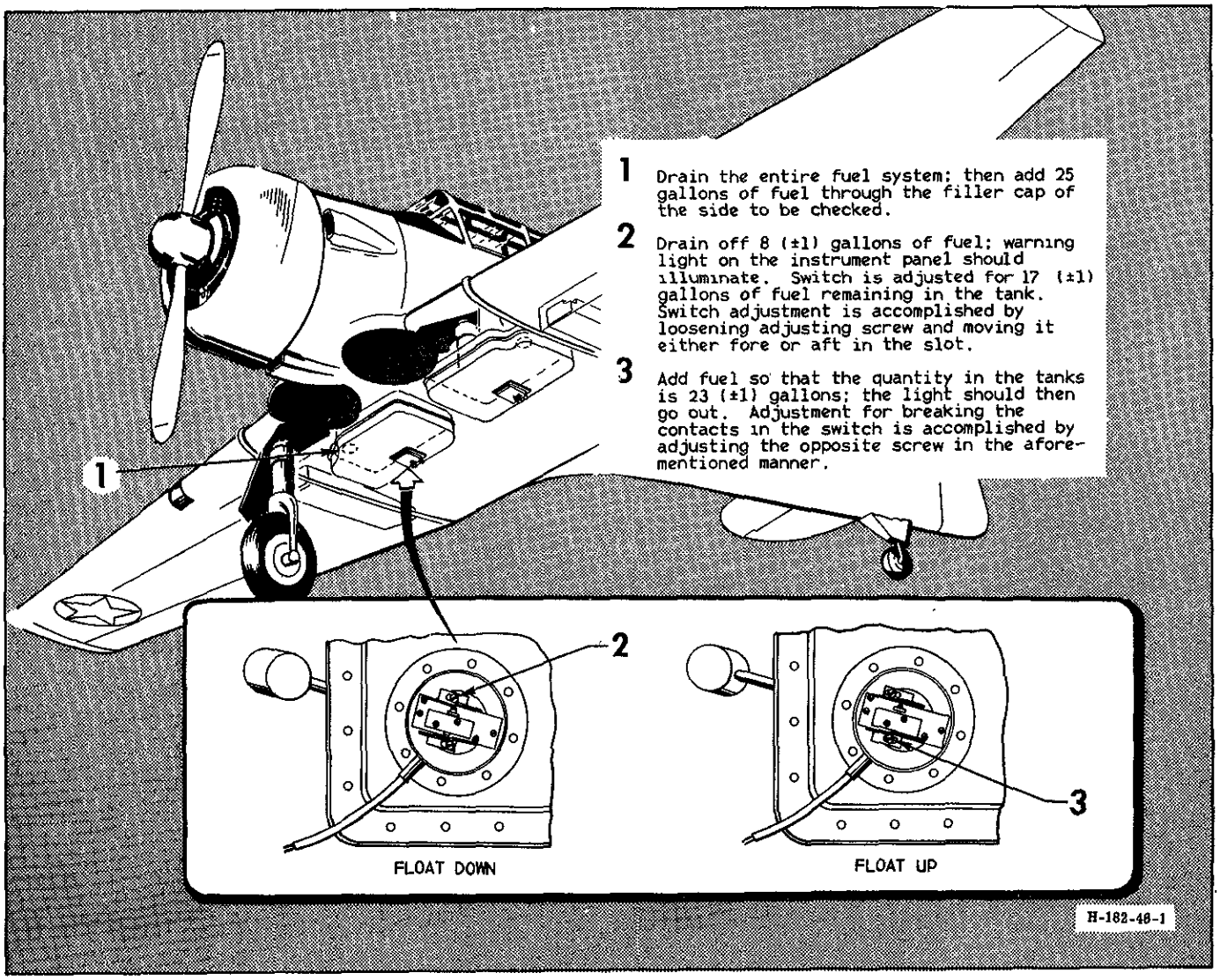


Figure 4-56A. Adjusting Fuel Low-level Warning System in Three-point Position

4-322. FUEL SELECTOR VALVE.

4-323. The fuel selector valve is located in the center section structure, aft of the left fuel tank gage assembly, and is connected by means of rod linkage to the dial selectors located on the control shelf. Fuel tank dial selectors are provided in both front and rear cockpits, forward of the trim tab controls in the rear cockpit and aft of the trim tab controls in the front cockpit. Fuel may be taken from either the right tanks or left tanks, by turning the dial selector to either of these positions as indicated on the dial selector face plate. When selector is turned, the rod linkage revolves the core in the selector valve, thus aligning an opening in the core with the passage connected to the fuel line from the selected tanks. The fuel will then flow from the tank through the selector valve and on to the fuel unit. To shut off the flow of fuel to the engine, turn the selector valve to the "OFF" position.

4-324. ADJUSTING FUEL SELECTOR VALVE HANDLE. To adjust the fuel selector valve handle, first position selector valve to off position. The selector valve is in the off position when the red-painted ears of the selector valve operating mechanism, i.e., the ears with the smallest distance between them, are inboard. Then proceed as follows:

a. Loosen handles in both cockpits, and rotate them until they point to "OFF" position.

b. Tighten handle attaching bolts.

4-325. FUEL LOW-LEVEL WARNING SYSTEM.

4-326. The fuel low-level warning system consists of a float-actuated switch in each center wing tank, and indicator lights for each float switch. As the fuel level in the tank is reduced to 10 to 12 gallons, the float in the tank actuates the switch that completes the circuit, illuminating the indicator light.

4-327. ADJUSTING FUEL LOW-LEVEL WARNING SYSTEM IN LEVEL POSITION. See figure 4-57.

4-327A. ADJUSTING FUEL LOW-LEVEL WARNING SYSTEM IN THREE-POINT POSITION. See figure 4-56A.

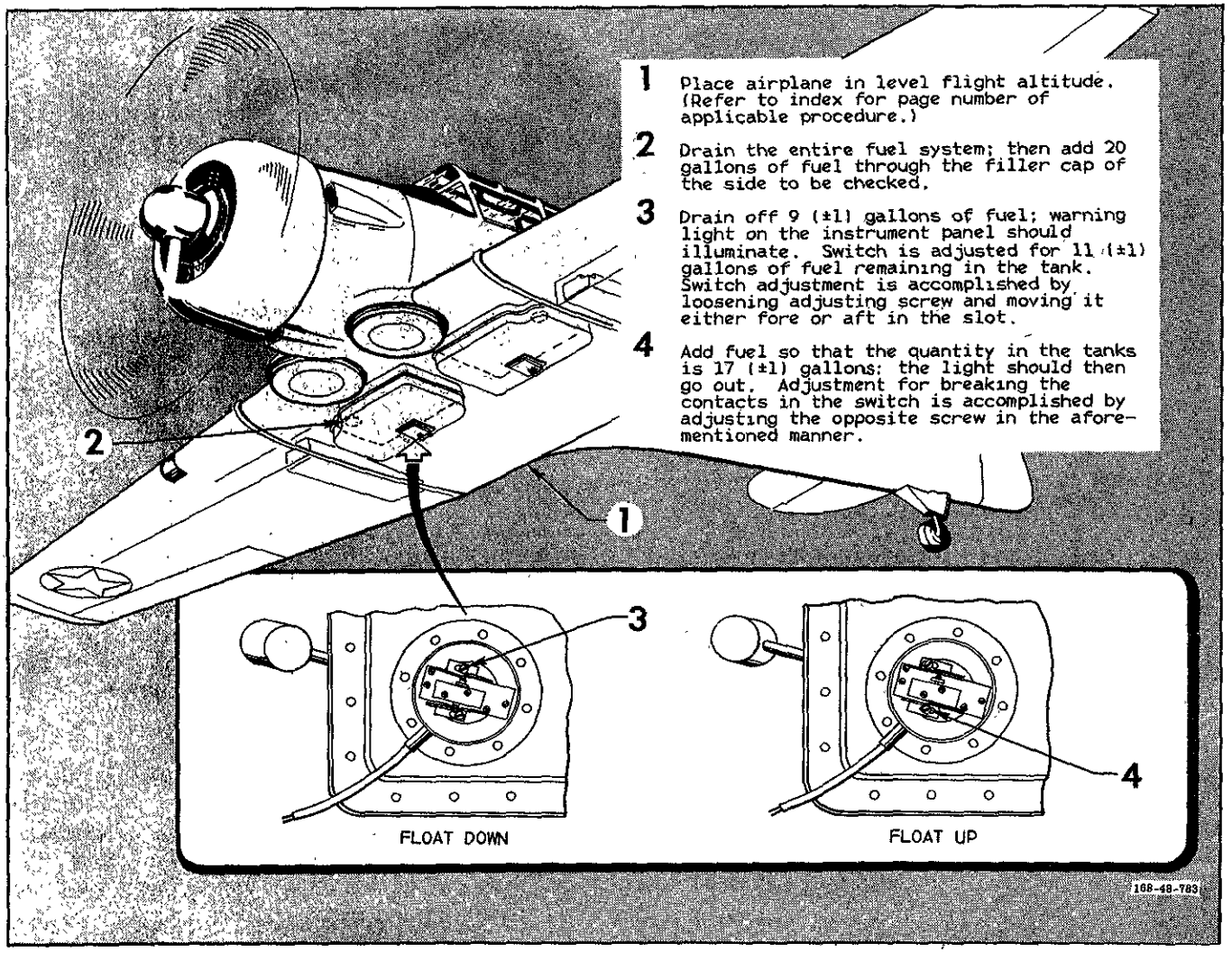


Figure 4-57. Adjusting Fuel Low-level Warning Switches

4-328. FUEL GAGES.

4-329. Individually lighted direct-reading fuel gages are installed at each side of the front cockpit seat on the right and left center wing tanks. The fuel gage lights are controlled from either cockpit, and the gages are visible from either cockpit.

NOTE

Rheostat control for brilliancy of the fuel gage lights is from the front cockpit only.

4-329A. ADJUSTING FUEL QUANTITY INDICATING GAGES. To adjust the fuel quantity indicating gages proceed as follows:

a. Position fuel selector to "OFF" position.

b. Drain fuel from center wing tank by removing sump plug and from outer wing cell by opening drain valve at aft end of cell.

c. Remove center wing tank (paragraph 4-309).

d. Remove fuel gage and check for freedom of float movement.

e. Place tank in normal flight position (horizontal) and install fuel gage into tank with four equally spaced screws.

f. Check for "0" (empty) reading; then invert tank to a horizontal position and check for "70 GAL." (full) reading. If a discrepancy exists in either the "0" (empty) or "70 GAL." (full) readings, remove fuel gage and carefully bend float arm to compensate for inaccurate readings.

g. Reinstall fuel gage into tank with four equally spaced screws and continue to check readings until satisfactory "0" (empty) and "70 GAL." (full) indications are obtained.

h. Install fuel gage in tank; then install center wing tank (figure 4-55).

i. Install fuel gage light.

j. Fill the tank to capacity (paragraph 3-24).

4-329B. AUXILIARY FUEL SYSTEM.

4-329C. LT-6G Airplanes have provisions for carrying a 55-gallon external droppable fuel tank. (See figure 4-57A.) The provisions consist of a Type S-2 bomb rack and four sway braces that support the tank under the wing center section, pressurization and fuel feed plumbing, a fuel manifold fitting, fuel shutoff valve, an auxiliary fuel low-level warning switch and lights, and a mechanical tank release cable system. Auxiliary fuel transfer is accomplished by pressurizing the drop tank to 4-1/2 (± 1/2) psi. The pressurization air is derived from the discharge side of the vacuum system of the airplane. The tank is pressurized continuously when the engine is operating. Auxiliary fuel feed is selected by closing the drop tank fuel switch on the upper left corner of the forward instrument panel. The drop tank fuel (being under greater pressure than the normal fuel) is forced through the open fuel shutoff valve and the fuel manifold fitting, into the normal fuel line upstream of the fuel unit. When all but approximately 2 gallons of the auxiliary fuel is consumed, a float-actuated switch within the tank closes and illuminates a low-level warning light on each instrument panel. The drop tank fuel switch is then turned "OFF" to ensure that internal fuel does not enter the drop tank or is spilled overboard through the auxiliary transfer line when the tank is dropped. The tank may be dropped electrically in salvo with all external stores of the airplane, by closing the master jettison switch or turning the master selector switch to "JETTISON"; normal electrical release of the tank is accomplished by moving the master selector switch to "FUEL TANK." When the green indicating light on the armament control panel illuminates (indicating that only the tank salvo circuit is ready to be energized), the bomb and rocket switch on the forward control stick is closed to drop the tank. In case of electrical failure, the tank may be released from the airplane by pulling the tank release cable handle in the front cockpit. This mechanically trips the bomb rack to release the tank.

4-329D. AUXILIARY FUEL TANK. The auxiliary fuel tank is constructed of aluminum and has a total capacity of 55 gallons. The tank is supported under the wing center section by a single bomb rack with four sway braces. The tank contains an inlet line screen which is removable through a plug in the forward bottom of the tank, a tank drain plug near the rear bottom of the tank, and a low-level warning float-actuated switch. The tank cannot be disassembled.

4-329E. REMOVING AUXILIARY FUEL TANK. To remove the auxiliary fuel tank on the ground, proceed as follows:

a. Drain the tank by removing the drain plug on the bottom rear of the tank.

b. Provide suitable means of catching or supporting tank when released; then pull manual tank release handle in front cockpit.

c. If tank is not to be reinstalled, disconnect manual release cable from bomb rack, disconnect bomb rack electrical lead, and remove the eight bolts securing bomb rack and sway braces to the wing center section.

d. Install plugs over wing center section fuel and air pullaway openings and suction vent line opening.

4-329F. INSTALLING AUXILIARY FUEL TANK. To install the auxiliary fuel tank, proceed as follows:

a. Secure the four tank sway braces to the wing center section, using eight AN4-13A bolts and eight AN960D416 washers.

b. Remove the plugs from the fuel and air disconnect fitting openings and suction vent line opening on bottom of wing center section.

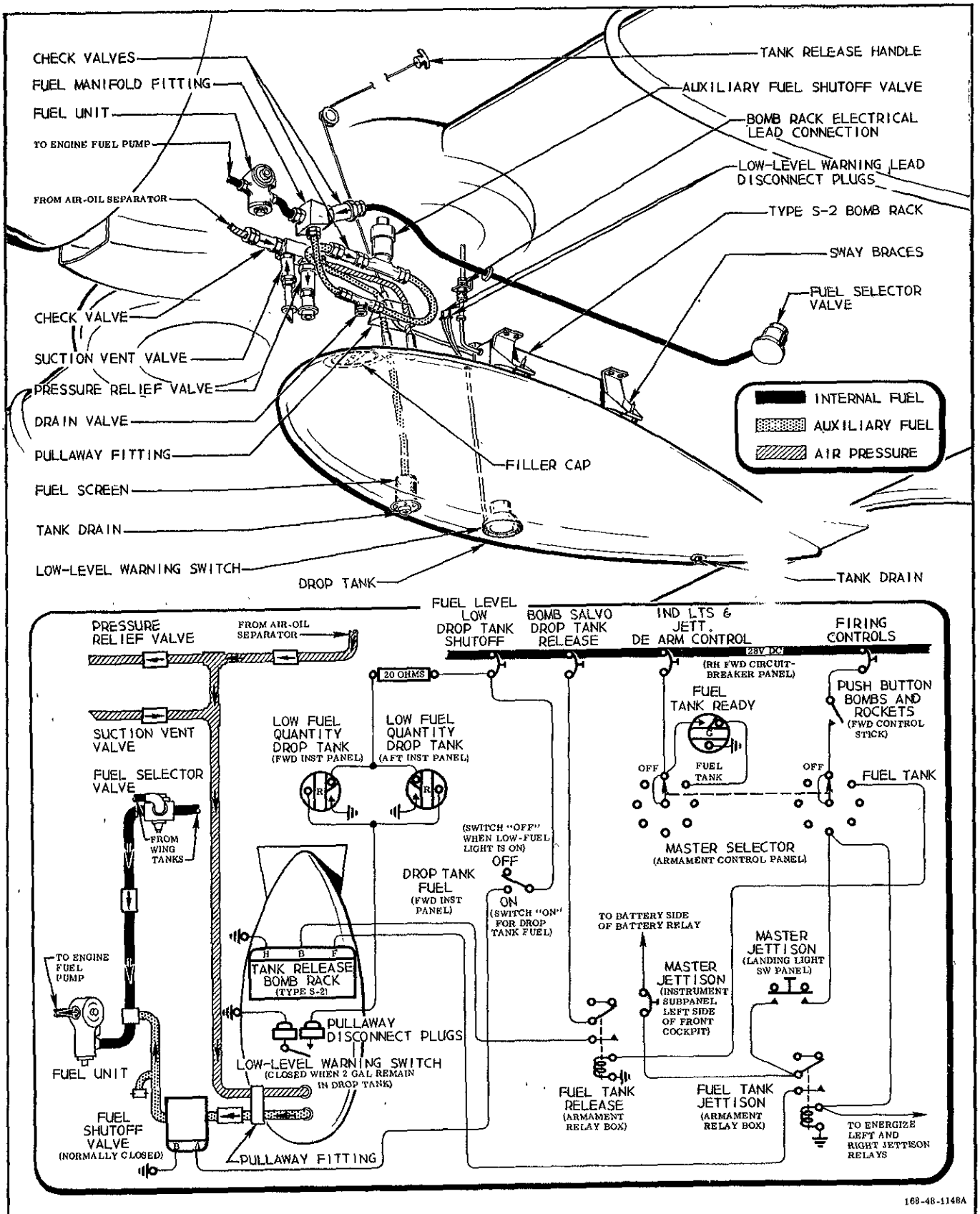


Figure 4-57A. Auxiliary Fuel System (LT-6G Airplanes)

c. Install a standard Type S-2 bomb rack to the four tank sway braces, utilizing four AN5-24A bolts, four AN365-516 nuts, and four AN960D516 washers.

d. Connect bomb rack electrical lead to airplane connection.

e. Cock the bomb rack by manually pulling the rack cocking lever aft. Push the cockpit tank release handle forward; then attach tank release cable to cocked bomb rack. Pull tank release handle and note that bomb rack releases.

f. Hoist the tank into place under the released rack; then apply upward pressure on tank with tank lugs against bomb rack hooks, until bomb rack automatically cocks. Cocking of the rack may sometimes be expedited by the use of the rack cocking slide ring which should be pulled sharply aft and released.

g. Adjust the tank sway braces until all tank side movement is removed when tank is hanging vertically.

h. Connect fuel and air line fitting to tank and wing center section.

i. Connect low-level warning electrical lead. Low-level warning light on each instrument panel should illuminate when power is turned on (tank empty).

j. Fill tank to capacity. (Refer to paragraph 3-24A.)

4-330. HYDRAULIC POWER SYSTEM.

4-331. The hydraulic power system is an open-center type system, automatically pressurized or depressurized by a power control valve. The power system supplies hydraulic pressure for operation of the landing gear and wing flaps. Normal operating pressure of 1000 psi is supplied by an engine-driven, pressure-loaded, gear-type pump. A hand-pump is incorporated in the system for ground use only. A hydraulic pressure gage is located on a panel directly below the instrument panel in the front cockpit. For detailed explanation of each individual system operation, refer to the respective paragraph of the unit being operated. (See figure 4-58.)

4-332. HYDRAULIC POWER SYSTEM OPERATION.

4-333. Fluid from the system reservoir is supplied to the engine-driven hydraulic pump. Pressure output of the pump is directed to the power control valve, which is positioned by linkage from the landing gear control handle and the wing flap control handle. When the power control valve is disengaged or inoperative, pressure from the pump is ported through the control valve and returned directly to the system reservoir. The hydraulic system is then an open-center type system and is depressurized. Movement of either the landing gear control handle or the wing flap control handle, for selection of operation, positions or engages the power control valve. Pump pressure is then ported to the system control valve, pressurizing the system selected for operation. A time-lag unit in the power control valve automatically disengages the valve after a pre-determined length of time has elapsed, following the operation of the selected unit. When the valve has become disengaged, the pump pressure is again returned to the reservoir, depressurizing the system. A hand-pump, located in the left-hand engine section, is incorporated in the hydraulic system for ground operational checkout, as it is inaccessible in flight.

4-334. TROUBLE SHOOTING HYDRAULIC SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
System not building up sufficient pressure.	Wrong direction of shaft rotation.	Check to see that direction of rotation of pump corresponds with direction of rotation of engine drive.
	Fluid level in reservoir low.	Fill reservoir.
	Air leak in suction lines.	Tighten fittings, and replace faulty lines, if necessary.
	Pump shear-coupling sheared.	Repair or replace pump.
	Pump not primed.	Prime pump by filling half-full of hydraulic fluid.
System unable to maintain pressure.	Leakage in system due to loose fittings.	Tighten or replace fittings.
	Leakage in hydraulic units.	Replace seals.
	Faulty pressure relief valve in control valves.	Adjust or replace.
	Power control valve leaking, allowing pressure to return to reservoir in pressurized condition.	Replace time-lag needle, or replace unit.

TROUBLE	PROBABLE CAUSE	REMEDY
No system pressure available.	Faulty pressure gage.	Replace.
	Linkage from control handles to power control valve not adjusted properly.	Adjust.
	Pressure relief valve remaining in the open position.	Repair or replace.

4-335. ENGINE-DRIVEN HYDRAULIC PUMP.

4-336. An engine-driven, pressure-loaded pump (Pesco IP-263-E) is mounted on the left side of the engine accessory section. Since it is a gear-type pump, action is obtained by a pair of concisely meshed gears, rotating in a close-fitting housing. A channel, incorporating a ball-type check valve, scavenges fluid that has passed through the bearing lubricating grooves and returns it to the pump inlet port. The drive gear has a safety shear section that protects the pump in the event of pump failure due to excessive loading or jamming of gears.

4-337. REMOVING ENGINE-DRIVEN HYDRAULIC PUMP. To remove the engine-driven pump, proceed as follows:

a. Disconnect supply and pressure lines at pump.

b. Remove safety wire and the four mounting nuts attaching pump body flanges to engine; then remove pump.

4-338. INSTALLING ENGINE-DRIVEN HYDRAULIC PUMP. To install pump, proceed as follows:

a. If pump has been in storage, drain oil from pump, flush thoroughly with hydraulic fluid, and fill approximately half-full with fluid.

b. Place gasket over mounting studs on engine accessory case.

c. Note carefully the direction of rotation of the engine drive, making sure it corresponds with the rotation of the pump as indicated by the markings on the pump flange or body.

d. Mount pump in the position most desirable for hydraulic line connections. The adapter can be relocated by removing the four adapter screws, and replacing adapter in desired position.

e. Mount the pump on the engine, tighten mounting nuts, and secure with safety wire.

f. Connect hydraulic lines.

4-339. HYDRAULIC FLUID RESERVOIR.

4-340. The hydraulic reservoir is mounted on the control shelf at the left forward side of the rear cockpit. With the airplane in a three-point attitude, the one-gallon total capacity reservoir has a fluid area of .77 gallon, the remaining air space being used for expansion. A filler neck with an overflow scupper and drain line provides a means of accurately filling the reservoir to overflowing. Fluid entering the reservoir through the return port is deflected upward by a V-shaped baffle, thus preventing foaming of the fluid.

4-341. HYDRAULIC CONTROL VALVE.

4-342. The wing flap and landing gear control valves comprise the lower portion of the control valve unit, mounted below the control shelf at the forward left side of the rear cockpit. The two valves are identical; the outboard valve is the landing gear control valve, and the inboard valve is the wing flap control valve. The two horizontal boxes in the body of the unit are interconnected with drilled flow channels, which permit the flow of fluid to and from the various component valves in the unit. Mechanical linkage from the control handles to the control valves controls selection and operation of the valves. (See figure 4-59.)

4-343. HYDRAULIC POWER CONTROL VALVE.

4-344. The hydraulic power valve is incorporated in the upper portion of the control valve body, mounted below the control shelf in the forward left side of the rear cockpit. Also included in the unit are the landing gear and wing flap one-way check valves and the pressure relief valve. Mechanically positioned by linkage, the power control valve directs flow of fluid pressure from the pump to the control valve in the engaged position, and from the pump back into the reservoir in the disengaged position. The time-lag unit in the power control valve automatically disengages the valve after a predetermined length of time has elapsed. The time lag may be changed by adjustment of the turnbuckle link attached to the time-lag valve piston. Tightening the turnbuckle will decrease time lag; loosening the turnbuckle will increase time lag.

4-345. ADJUSTING POWER CONTROL VALVE. The time lag of the power control valve will vary widely with extremely high or low fluid temperatures; the valve should be adjusted so that the time-lag unit disengages in not less than 40 seconds at fluid temperatures of 60°C (140°F) and should not exceed 4 minutes

4-350. ELECTRICAL POWER AND LIGHTING SYSTEMS.

4-351. The electrical power system is divided into two systems: the d-c system and the a-c system. The d-c system is a single-wire, single-bus, 28-volt system. Primary direct current is supplied to the bus system by a 50-ampere, engine-driven generator. A 24-volt storage battery is connected to the bus system and serves as an auxiliary source of power when the generator is not delivering power. There are provisions for connecting an external source of d-c power to the bus system for use in starting and ground checking various electrical units. Any point in the metallic structure of the airplane can serve as a ground. The a-c system consists of two inverters: a single-phase, 400-cycle, 6 volt-ampere, 26-volt inverter used to power the remote compass system; and a single-phase, 250 volt-ampere, 400-cycle, 115-volt inverter to power the radio compass system. Wiring is in open bundles, with some of the wires in shielding to suppress radio noise. All electrical circuits are protected by circuit breakers on the console panel on the right side of the front cockpit. With the exception of ignition and interior lighting in rear cockpit, all electrical circuits are controlled from the front cockpit.

4-352. TROUBLE SHOOTING ELECTRICAL SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
	GENERATOR	
With generator switch open, test voltmeter low-voltage output.	Faulty or improperly adjusted voltage regulator.	Adjust voltage regulator.
	High-resistance internal or external connections in generator circuit.	Service the external connections, or replace generator.
	Binding, worn, improperly seated, or loosely fitting brushes.	Service the brushes.
	Low brush spring tension.	Test the brush springs.
	Dirty commutator.	Clean the commutator with unleaded gasoline.
	Scored or pitted commutator.	Replace commutator.
	Shorted, grounded, or open armature.	Replace generator.
Test voltmeter indicates high generator voltage.	Voltage regulator not in proper operating condition.	Adjust regulator.
With generator switch open, test voltmeter indicates erratic or fluctuating generator output voltage.	Unstable operation or voltage regulator.	Replace regulator.
	High-resistance internal or external connections in generator circuit.	Service the external connections, or replace generator.
	Binding, worn, improperly seated, or loosely fitting brushes.	Service the brushes.
	Low brush spring tension.	Replace brush springs.
	Dirty commutator.	Clean the commutator with unleaded gasoline.
	Scored or pitted commutator.	Replace commutator.

TROUBLE	PROBABLE CAUSE	REMEDY
	Shorted, grounded, or open armature.	Replace generator.
	Generator field magnetized in the wrong direction.	Flash the field in the proper direction.
	External wiring not properly connected.	Refer to wiring diagram and properly connect all wiring connections.
	Improper operation of generator cutout.	Adjust generator cutout.
With generator switch closed, system ammeter indicates zero output current.	Improper operation of generator cutout.	Adjust generator cutout.
	Generator field demagnetized.	Flash the field in the proper direction.
	Defective ammeter.	Replace ammeter.
	Faulty generator switch.	Replace generator switch.
	Faulty or improperly adjusted voltage regulator.	Adjust voltage regulator or replace faulty voltage regulator.
	High-resistance, loose, grounded, or broken connections.	Service the external connections, or replace generator.
	Shunt field coil, assembly open, shorted, or grounded.	Replace the field coil assembly.
	(Deleted)	(Deleted)
	Shorted, grounded, or open armature.	Replace generator.
	Faulty airplane wiring.	Refer to wiring diagram and correct faulty wiring connections.
System ammeter reads too high.	Battery shorted or discharged.	Install fully charged battery.
System ammeter indicates low output current.	Faulty or improperly adjusted voltage regulator.	Adjust voltage regulator or replace faulty voltage regulator.
	High-resistance internal or external connections in generator circuit.	Service the external connections, or replace generator.
	Binding, worn, improperly seated, or loosely fitting brushes.	Service the brushes.
	Low brush spring tension.	Replace brush springs.
	Dirty commutator.	Clean the commutator with unleaded gasoline.
	Scored or pitted commutator.	Replace commutator.

TROUBLE	PROBABLE CAUSE	REMEDY
	Shorted, grounded, or open armature.	Replace generator.
System ammeter reads off scale in the wrong direction.	Generator field magnetized in the wrong direction.	Flash the field in the proper direction.
	External wiring not properly connected.	Refer to wiring diagram and properly connect all wiring connections.
	Ammeter connected backward.	Reverse ammeter leads.
	Improper operation of generator cutout.	Adjust generator cutout.
System ammeter or voltmeter fluctuates excessively.	Improper operation of generator cutout.	Adjust generator cutout.
	Improper adjustment of voltage regulator.	Adjust voltage regulator.
	Loose connection or grounds in airplane wiring.	Refer to wiring diagram and tighten all wiring connections and grounds.
Excessive sparking at generator brushes.	High-resistance internal or external connections in generator circuit.	Service the external connections, or replace generator.
	Binding, worn, improperly seated, or loosely fitting brushes.	Service the brushes.
	Low brush spring tension.	Replace brush springs.
	Dirty commutator.	Clean the commutator with unleaded gasoline.
	Scored or pitted commutator.	Replace commutator.
	Shorted or open armature.	Test and, if necessary, replace the armature assembly.
Short brush life.	Binding, worn, improperly seated, or loosely fitting brushes.	Service the brushes.
	Low brush spring tension.	Replace brush springs.
	Dirty commutator.	Clean the commutator with unleaded gasoline.
	Scored or pitted commutator.	Replace commutator.
	Shorted, grounded, or open armature.	Replace generator.
	Wrong type of brush being used.	Replace the brushes with brushes of the proper type.
	Ball bearings worn or rough turning.	Replace the ball bearings.

TROUBLE	PROBABLE CAUSE	REMEDY
Noisy radio operation.	Faulty condensers in filter circuit (if used).	Replace faulty radio filter condenser.
	Discharged battery.	Replace the discharged battery.
	Excessive sparking at generator brushes.	Check for cause of sparking. Repair as necessary.

4-353. ELECTRICAL POWER SYSTEMS.

4-354. BATTERY SYSTEM.

4-355. The battery system consists of a battery, a battery-disconnect relay, a mercury switch, and a battery-disconnect switch. The 24-volt, 34 ampere-hour battery (AN3150-A), mounted on the right forward side of the engine firewall, stores energy for use in powering the bus system when no other power from generator or external source is available. An access door to battery compartment is provided for emergency use. The battery is connected to the bus system through a solenoid (Type B-4 in the main power panel) when the battery switch, on the right console panel in the front cockpit, is closed. The mercury switch, connected in series with the battery switch and Type B-4 solenoid coil, opens the battery circuit when airplane is in an inverted flight attitude. This feature protects battery from damage, such as explosion due to excessive gas pressure preventing the battery vents from opening after the airplane regains its normal flight position. Other than the mercury switch, there are no protective devices in the battery circuit.

4-356. REMOVING BATTERY. Remove battery in the following manner:

a. Remove engine accessory cowlings on both sides and bottom of engine.

b. Remove quick-disconnect assembly from battery terminals.

c. Remove vent lines from battery.

d. Release battery tie-down rods from battery cover.

e. Remove battery from mount.

4-357. INSTALLING BATTERY. Install battery in the following manner:

a. Place battery on mounting. Make sure rubber gasket is installed under battery cover.

b. Insert tie-down rods in slots and tighten securely.

c. Attach battery vent tubing to battery vents.

d. Attach quick-disconnect assembly to battery.

e. Install engine cowling.

4-358. GENERATOR SYSTEM.

4-359. The d-c generator system (figure 4-61), which furnishes the primary source of power to the bus system, consists of a generator, generator relay, voltage regulator, a current limiting resistor, two ammeters, an ammeter shunt, a radio noise filter, and a control switch. The system generates and maintains a regulated 28-volt source for the bus system. The voltage regulator holds the system voltage to the 28-volt value regardless of load variations and speed of generator. The relay automatically connects and disconnects the generator to the bus system when the control switch, on right console panel in the front cockpit, is closed. In order to regulate horsepower absorbed by the generator from the engine, under low battery condition, thus preventing this horsepower from becoming excessive enough to cause damage to the engine generator drive assemblies, a .125-ohm, 90-watt resistor is installed between the battery relay and the bus system in the generator control panel. On Airplanes AF51-14401 through AF51-15137 and AF51-17354 and subsequent, the resistor is relocated on the exterior of the generator control panel. The resistors value is changed to .125 ohms, 125 watts on Airplanes AF51-14508 through AF51-15137 and AF51-17354 and subsequent. The two 150-ampere ammeters, one installed on each instrument panel, are parallel-connected across the 50-millivolt shunt mounted in the generator control panel. A CA-275X radio noise filter, in the generator control panel, is connected between the generator output lead and ground.

4-360. GENERATOR.

4-361. The generator (Type M-3), which delivers 28 volts direct current at 50 amperes, is mounted at the top center end of the engine accessory case. The unit, which is self-excited, consists of six field coils connected in series to form what is called the shunt field coil assembly, and utilizes a four-brush rigging. The armature is supported by a completely sealed roller bearing at each end. Cooling is accomplished by an integral fan on the engine end of the generator.

4-362. REMOVING GENERATOR. Remove generator in the following manner:

a. Remove top engine accessory cowling.

b. Remove power receptacle from plug on generator.

c. Remove four mounting nuts, and lift unit straight up and out of engine.

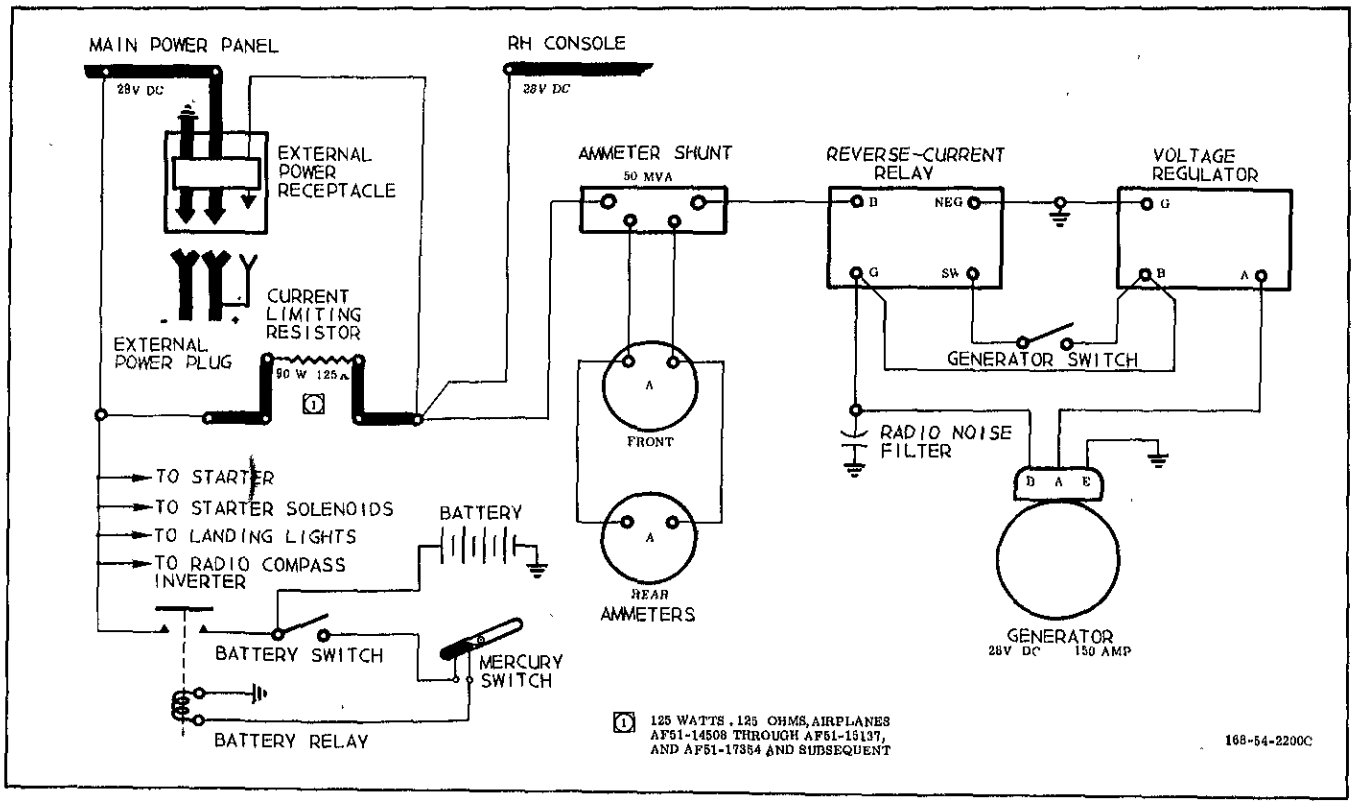


Figure 4-61. Battery and Generator System Wiring Schematic

4-363. INSTALLING GENERATOR. *Install generator* in the following manner:

a. Clean off engine pad and cover with a new gasket.

b. Coat the generator drive spline with grease.

c. Mount generator to engine pad and secure in place with the four mounting nuts.

d. Install power receptacle.

e. Install top engine accessory cowling.

4-364. FLASHING GENERATOR. An off-scale ammeter indication in the wrong direction often reflects generator field magnetized in the wrong direction. To remedy this condition, flash generator in the following manner:

a. Place generator switch in the "OFF" position.

b. Remove voltage regulator from its mount in generator junction box.

c. Locate position of nearest convenient terminal or bus in the bus system for source of battery power. Connect external voltmeter between this point and ground.

d. Connect one end of a suitable length of No. 18 or larger wire to generator "A" lead terminal on voltage regulator base.

e. With the engine operating at normal cruising rpm, touch for approximately one second the other end of wire to the point in bus system located in step c. and note if there is a voltage indication on voltmeter.

f. If there is a voltage indication, reinstall voltage regulator in generator junction box, turn generator switch on, and note if the system is operating properly. If it is not, refer to trouble shooting chart for possible cause of trouble.

4-365. REPLACING GENERATOR BRUSHES. When brushes reach a length of 1/2 inch, they must be replaced as follows:

a. Remove generator front head cover for access to brushes.

b. Remove all brush leads from brush boxes.

c. Lift the brush spring and remove brush. Repeat this procedure for all four brushes.

d. Lift brush springs and insert new brush, making certain the brush fits freely and that spring bears centrally on the top of the brushes.

e. Reconnect the brush lead terminals, noting that there are no twists in the brush leads.

NOTE

When replacing brushes, a brush spring tension test should be made in accordance with paragraph 4-366.

f. Run in brushes until at least 75 percent of the contact surface of each brush is seated. This is usually accomplished on a bench test setup. A brush run-in could be made on the airplane; however, from the standpoint of fuel consumed, this would not be practical.

g. After brush run-in, reinstall generator front head cover.

4-366. TESTING BRUSH SPRING TENSION. Test brush spring tension in the following manner:

a. Remove generator front head cover.

b. Insert the hook of a standard 0- to 6-pound spring scale under the brush spring, and lift spring to a position 1/8 inch above the top of the brush box. The tension should measure 20 to 24 ounces. If tension does not fall within the specified limits, hold spring adjusting sleeve with a standard screwdriver and remove cotter pin. Alter the position of sleeve with screwdriver until tension is within the 20- to 24-ounce tolerance. Insert cotter pin and remove screwdriver. Repeat this procedure for all four brushes.

c. After all springs have been checked, reinstall generator front head cover.

4-367. REVERSE-CURRENT RELAY.

4-368. A 200-ampere reverse-current relay (AN-3025-1) is installed in the generator junction box on the upper forward left side of fuselage just aft of the firewall. This relay connects the generator to the electrical bus system when generator output voltage reaches 26.5 or above, or the relay will disconnect generator from the line because of reverse current (16 to 18 amperes) when generator output falls below 26.5 volts. In either case, the generator control switch must be closed.

4-369. ADJUSTING REVERSE-CURRENT RELAY. Adjust reverse-current relay in the following manner:

a. Remove access panel on forward left side of airplane so as to gain access to the generator junction box where relay is located.

b. Remove box cover. Connect positive lead of an external voltmeter to the "B" relay terminal, and the negative lead to metal structure of airplane.

c. Start engine and permit it to attain operating temperature.

d. Close generator switch.

e. Gradually increase engine rpm until a current indication is noted on ammeter on instrument panel; at the same time, the voltmeter will show a slight drop as reverse-current relay closes. The voltmeter must indicate between 26 and 26.5 volts immediately before relay closes, as this indication is the relay closing voltage. If voltage is not within the tolerance, turn the adjustment screw on relay until there is a proper cut-in voltage indication.

NOTE

In areas where batteries boil or gas excessively because of climatic conditions, voltage regulators may have to be set as low as 27.25 volts (never lower). If this adjustment is necessary, reverse-current cut-in voltage will have to be set for between 26 and 26.5 volts.

f. After adjustment is made, remove voltmeter from generator circuit, reinstall cover to junction box, and install airplane access panel.

4-370. VOLTAGE REGULATOR.

4-371. A carbon pile voltage regulator (Specification No. 94-32276) is mounted in the generator junction box on upper forward left side of the fuselage just aft of the firewall, and is accessible when access panel and junction box cover are removed. The voltage regulator, by controlling the amount of resistance inserted into the field circuit of the generator, automatically maintains a 28-volt, direct-current electrical system, regardless of variations of generator speed and conditions of varying electrical load.

4-372. ADJUSTING VOLTAGE REGULATOR. Adjust voltage regulator in the following manner:

a. Start engine and allow it to warm up. The generator and voltage regulator should be at operating temperature before making adjustment.

b. Place generator switch in off position.

c. Connect a portable precision voltmeter. Connect the positive lead to "B" terminal on voltage regulator base, and the other voltmeter lead to ground (airplane structure).

NOTE

Voltmeter (Stock No. 7800-961000) is satisfactory for voltage adjustment if it has been checked against another instrument of known accuracy within a 90-day period.

d. Increase the engine speed to normal cruising rpm (approximately 1800 rpm).

e. The voltmeter must indicate exactly 28.0 volts. If it does not, adjust knurled adjusting knob until voltmeter indicates correct figure. Turning knob clockwise will increase the voltage, and turning knob counterclockwise will decrease the voltage.

NOTE

In areas where ambient temperatures are high, the regulator may be set as low as 27.25 volts, in lieu of 28.0 volts. Such areas can be identified when considerable boiling of battery electrolyte is encountered.

f. Cut the engine, and remove voltmeter.

g. Install generator junction box lid and access door.

4-373. *EXTERNAL POWER RECEPTACLES.*

4-374. A power receptacle is installed on the left side of the fuselage just aft of the wing trailing edge. This receptacle provides a means of connecting a d-c power source of 28 volts dc to the bus system in the airplane, to be used during engine starting and ground checking electrical units. The receptacle is wired directly to the bus system so that when external power is connected to the receptacle, the bus system becomes "hot" immediately, there being no need to close the battery-disconnect switch.

CAUTION

When removing plug from the external power receptacle, apply an even and direct pull on cable and plug. Violent side motion or "rocking" of the plug may crack the receptacle.

4-375. *ALTERNATING-CURRENT SYSTEM.*

4-376. The alternating-current system consists of two separate a-c inverters: a single-phase, 400-cycle, 6-volt-ampere, 26-volt a-c inverter; and a 250-volt-ampere, 400-cycle, three-phase, 115-volt a-c inverter. The single-phase, 26-volt a-c inverter, located on the frame on the left side of the airplane just aft of the rear cockpit seat, powers the remote compass system. This inverter is connected to the bus system through a 5-ampere circuit breaker and will operate whenever the bus system is "hot." The 250 volt-ampere, single-phase, 115-volt a-c inverter, mounted on the shelf aft of the rear seat, supplies power for the radio compass system. This inverter is connected through a relay (BK22E) and circuit breaker to the bus. The output lead is protected by a fuse mounted externally on the back side of the relay box in the rear cockpit. Both inverter circuit breakers are mounted on the right-hand console in the front cockpit.

4-377. *ELECTRICAL INDICATORS AND TRANSMITTERS.*

4-378. The following electrically operated instruments are installed in the airplane: free air temperature indicators, carburetor mixture temperature indicators, tachometer indicators, engine gages, remote-compass

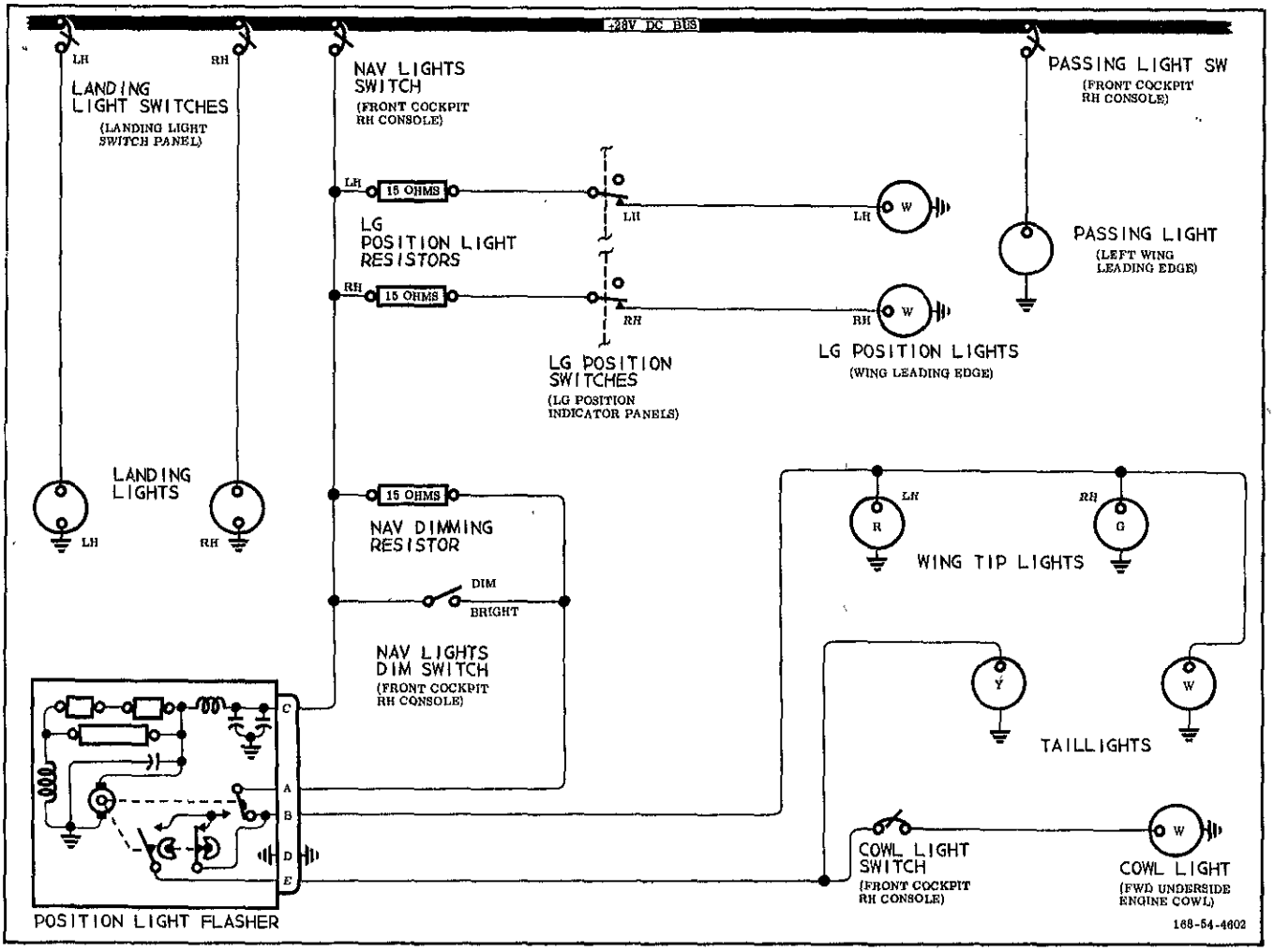


Figure 4-61A. Exterior Lighting System - Airplanes AF49-2897 Through AF49-3226

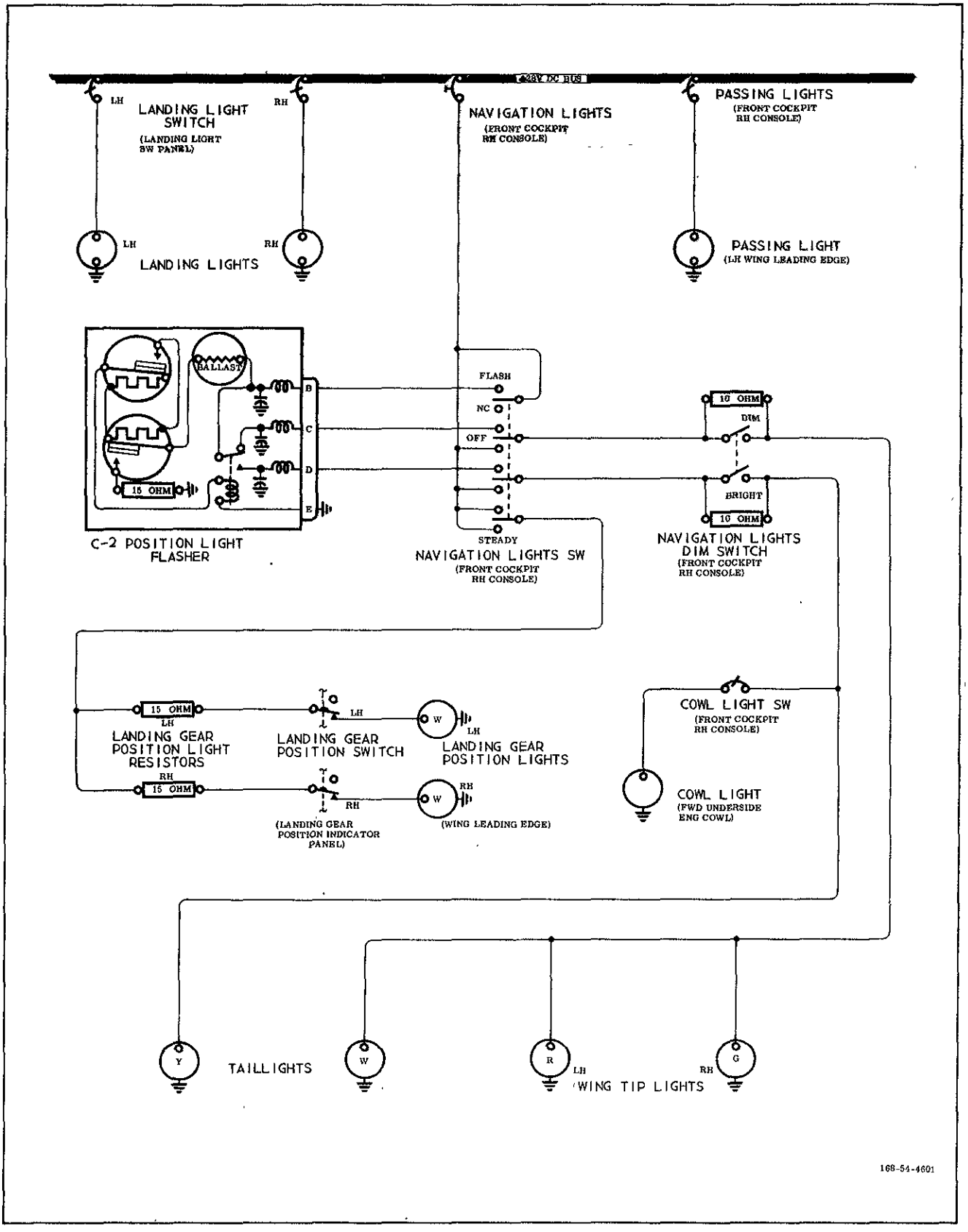


Figure 4-61B. Exterior Lighting System - Airplanes AF49-3227 and Subsequent

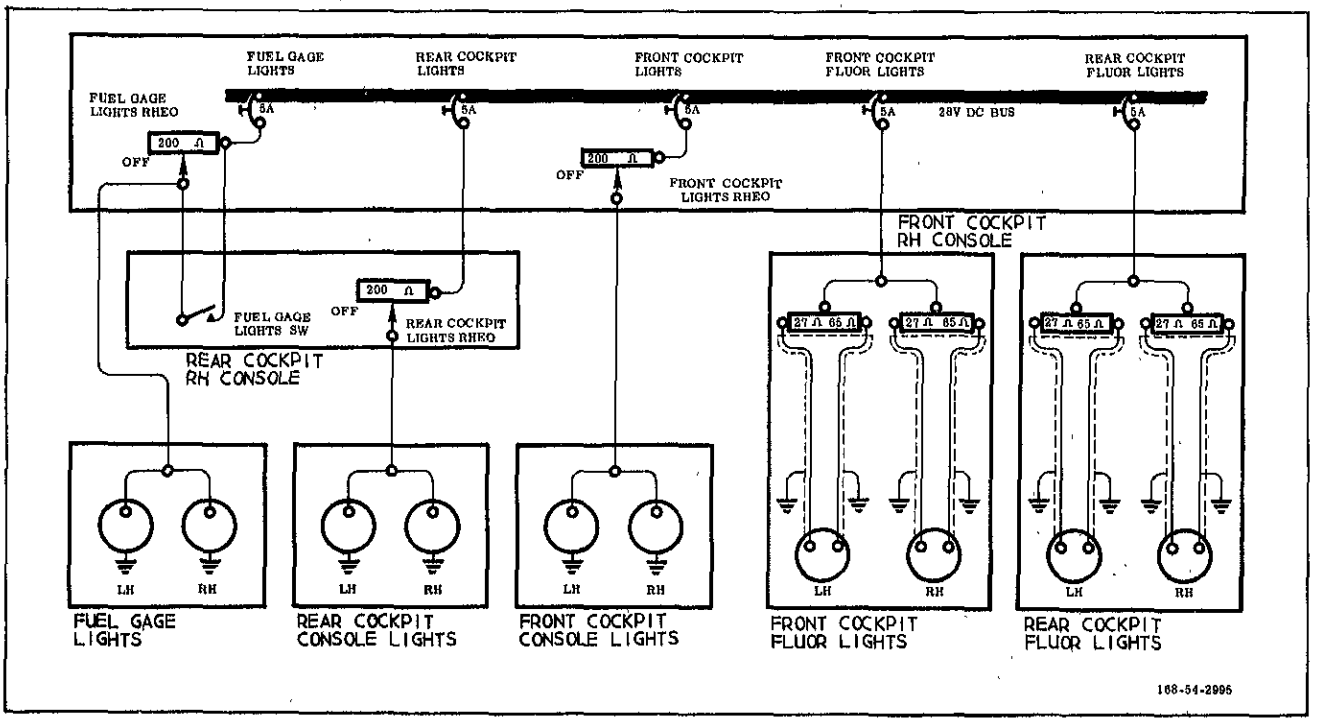


Figure 4-61C. Interior Lighting System

system, and turn-and-bank indicators (Airplanes AF49-2897 through AF49-2911). For information pertaining to these instruments, refer to paragraphs 4-439 through 4-467.

4-379. EXTERIOR LIGHTING.

4-380. The exterior lighting comprises the following: two landing lights, one passing light, a light on each wing tip (red on left, and green on right), and two tail position lights (white and amber), and a cowl light.

4-381. NAVIGATION LIGHTS. The navigation lights include a light on each wing tip (red on left, and green on right) and two taillights mounted one above the other on the bottom end of the rudder (amber above, and white below). These navigation lights are connected through a flasher unit (Bendix 450250-0-3 on Airplanes AF49-2897 through AF49-3226; C-2, Specification No. 32660, on Airplanes AF49-3227 and subsequent). See figures 4-61A and 4-61B for flasher schematic diagrams. These lights will operate as flashing lights when the navigation switch on right-hand console in front cockpit is closed. The lights flash in the following sequence: the two wing tip lights and white taillight flash, then the yellow taillight and cowl light. These lights will flash in this alternate order as long as the control switch is closed. With the exception of the cowl light, no provisions have been made for steady or individual operation of the lights. The cowl light may be cut out of the circuit by opening its respective circuit-breaker type switch mounted on the right-hand console panel in the front cockpit. Also on the same panel there is a switch that cuts a 15-ohm, 50-watt resistor in and out of the circuit for a dim or bright light. The system is safetied through the navigation switch. This is a 10-ampere circuit-breaker type switch. Lamp replacements are as follows: AN3122-1524 for wing tip lights, AN3124-307 for taillights, and AN3120-1047 for the cowl light.

4-382. LANDING LIGHTS. A 450-watt, 7-inch sealed-beam landing light (PAR-56) is installed in the leading edge of each wing behind a plastic hood. Each light, which draws approximately 16 amperes of current, is controlled by a 35-ampere circuit-breaker type control switch mounted on a panel in the forward left side of the front cockpit just below the instrument panel. The beam angle of the light is fixed.

4-383. PASSING LIGHT. A 50 candle-power passing light (Type B-3), with a red lens, is mounted in the same well occupied by the landing light in the left wing leading edge. The light is controlled by a 5-ampere circuit-breaker type toggle switch on the right-hand console panel in the front cockpit. For bulb replacement, use an AN3133-311 bulb.

4-384. INTERIOR LIGHTING.

4-385. The interior lighting consists of two console lights and two fluorescent lights in each cockpit, and two fuel gage lights.

4-386. CONSOLE LIGHTS. There are two console lights (AN3034-1), mounted one on each side of each cockpit. The lights, utilized for console panel and general lighting, shine downward. Each set of lights is controlled on and off, as well as dimmed, by a rheostat on the right-hand console panel in each cockpit. The circuit is protected by a 5-ampere circuit breaker.

4-387. FLUORESCENT LIGHTS. There are two fluorescent lights (Type C-8) mounted on each side of the instrument shroud in each cockpit. Each light has an integral rheostat (built into the back of the light) which can turn the light on or off as well as

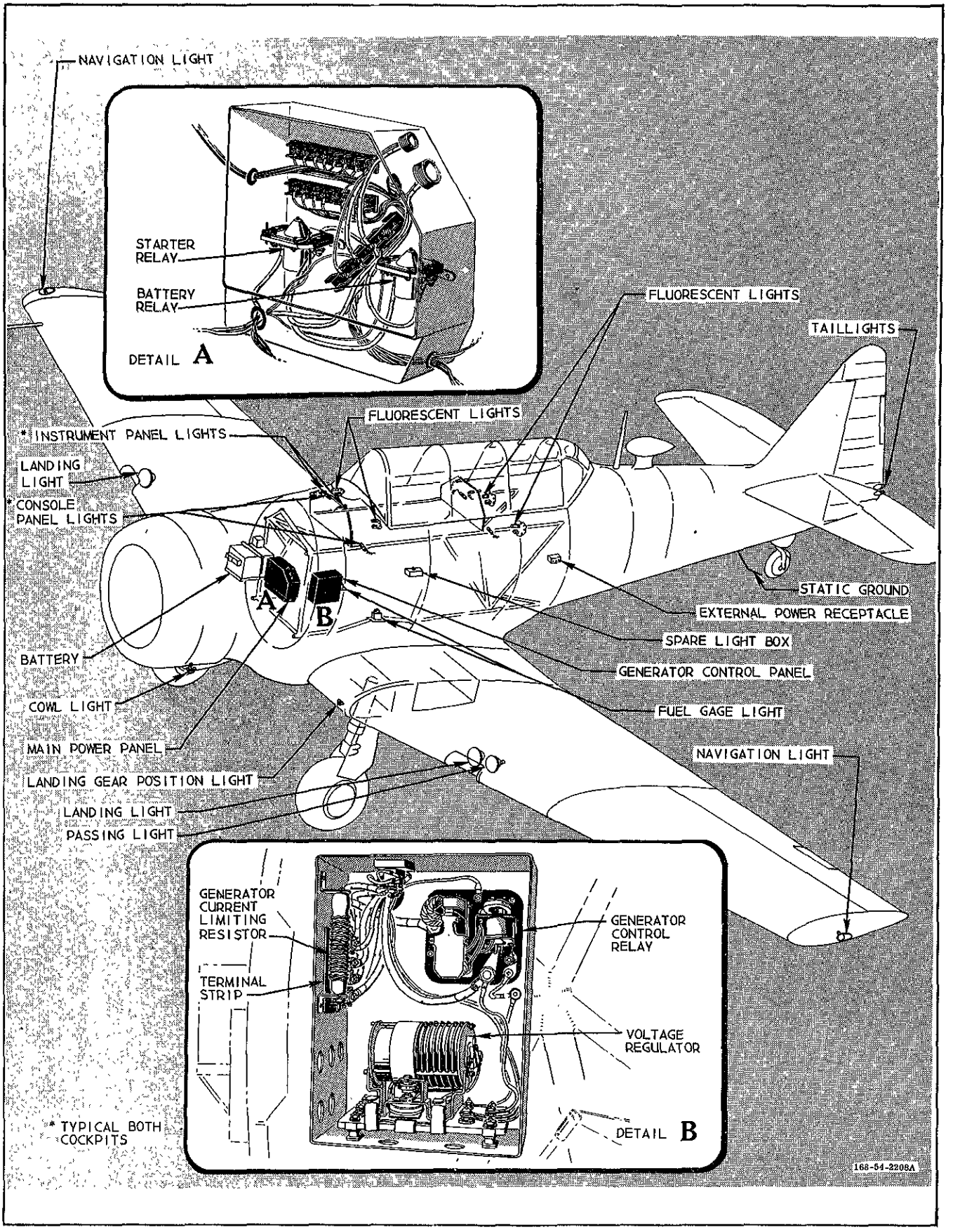


Figure 4-62. Electrical Power Units and Lighting Location

vary the brilliance of the lamp. Each set of lights is protected by a 5-ampere circuit breaker on the right-hand console panel in front cockpit.

4-388. FUEL GAGE LIGHTS. A light is mounted on the floor just forward of each fuel gage in the front cockpit. A rheostat, on the front console, is connected into the circuit for varying the brilliancy as well as turning off the light. A momentary-type toggle switch, on the rear console, is shunted across the rheostat to enable the person in that cockpit to by-pass the rheostat for a bright light on fuel gages when desired. The circuit is protected by a 5-ampere circuit breaker also on the front right-hand console panel.

4-389. ELECTRONIC SYSTEM.

4-390. The electronic equipment (figure 4-63) consists of the following:

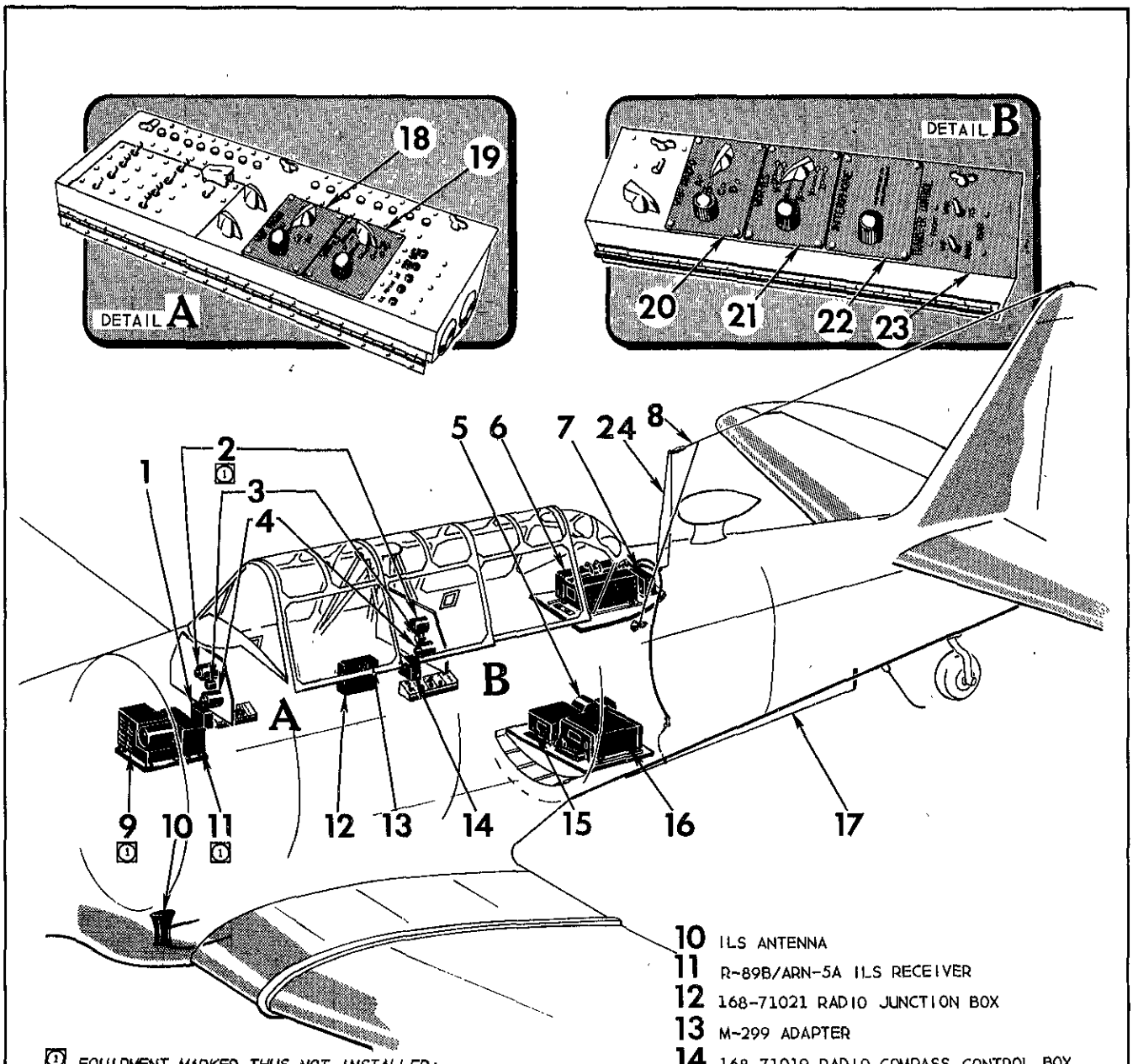
EQUIPMENT	FUNCTION
SCR-522-A COMMAND SET* Receiver (BC-624-A) Transmitter (BC-625-AM) Dynamotor (PE-94-C) Control Panel (168-71012) Control Panel (168-71077)† Antenna (AN104-B)	Two-way radiophone communication between airplanes in flight, and between airplanes and ground station.
AN/ARC-3 COMMAND SET** Receiver (R-77A/ARC-3) Transmitter (T-67/ARC-3) Power Junction Box (J-68/ARC-3) Dynamotor Receiver (DY-22/ARC-3) Dynamotor Transmitter (DY-21/ARC-3) Control Panel (C-404A/A) Antenna (AN104-B)	Airplane-to-airplane and airplane-to-ground station communication.
AN/ARN-7 RADIO COMPASS †† Receiver (R-5A/ARN-7) Control Box (C-4/ARN-7) Indicator (I-81-A) Loop Antenna (LP-21-LM) Relay (BK-22-E) Inverter (788-2B) Sense Antenna (W-106-A)	Orientation and direction finding.
AN/ARN-6 RADIO COMPASS**. Receiver (R-101A/ARN-6) Indicator (ID-90/ARN) Control Panel (C-403A/A) Loop Antenna (AS-313A/ARN-6) Sense Antenna (W-106-A) or (AS-315A/ARN-6)	Orientation and direction finding.
RC-193A MARKER BEACON* Receiver (BC-1033-B) Indicator Lamp (AN3157-4) Antenna (88-71719)	Indicates proximity to station.
AN/ARN-12 MARKER BEACON*** Receiver (R-122/ARN-12) Antenna (82-71719-5) Indicator Lamp (AN3157-4)	Indicates proximity to ground station.
INSTRUMENT LANDING SYSTEM††† Indicator (I-101-D) - Provisions Only Transfer Switch (AN3227-3) Receiver, Glide Path (R-89B/ARN-5A) - Provisions Only Receiver, Localizer (BC-733D) - Provisions Only	Blind approach.

EQUIPMENT	FUNCTION
Capacitor (3DKB1250) Control Panel (168-71016) Antenna (Modified AS-27A/ARN-5)	
INTERPHONE SYSTEM†† Control Panel (168-71014) Interphone Switch (AN3023-6) Relay (6213A)	Intercockpit communication.
USAF COMBAT INTERPHONE** Interphone Amplifier (AM-300/AIC) Interphone Mixer Amplifier (AM-142/AIC) Interphone Control Panel (C-695/AIC) Interphone Filter (F-21/ARA-9) Interphone Switch (AN3023-6)	Intercockpit communication.

NOTE

For detailed information concerning each item of equipment, consult the handbooks for the equipment or components involved, as listed in the current issue of the AF Index of Technical Publications and Confidential Orders.

*Airplanes AF49-2897 through AF49-3596
†Airplanes AF49-3538 through AF49-3596
**Airplanes AF49-3538 through AF49-3596, AF51-14314 through AF51-15137, and AF51-17354 and subsequent
††Airplanes AF49-2897 through AF49-3537 and AF50-1277 through AF50-1326
***Airplanes AF51-14314 through AF51-15137, and AF51-17354 and subsequent
†††Airplanes AF49-2897 through AF49-3537, AF50-1277 through AF50-1326, and AF51-14314 and subsequent

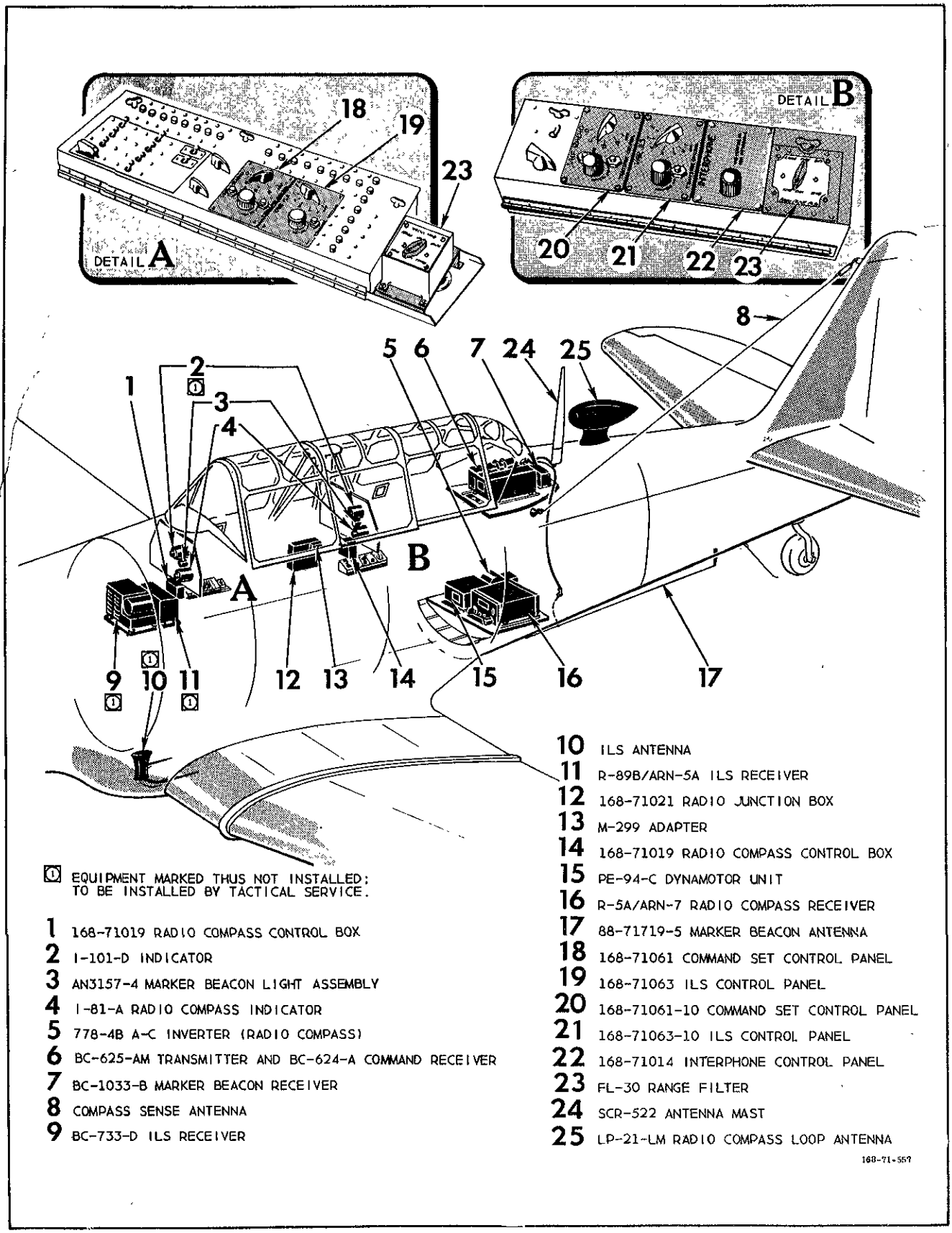


[1] EQUIPMENT MARKED THUS NOT INSTALLED; TO BE INSTALLED BY TACTICAL SERVICE.

1 168-71019 RADIO COMPASS CONTROL BOX
2 I-101-D INDICATOR
3 AN3157-4 MARKER BEACON LIGHT ASSEMBLY
4 I-81-A RADIO COMPASS INDICATOR
5 778-4B A-C INVERTER (RADIO COMPASS)
6 BC-625-AM TRANSMITTER AND BC-624-A COMMAND RECEIVER
7 BC-1033-B MARKER BEACON RECEIVER
8 COMPASS SENSE ANTENNA
9 BC-733-D ILS RECEIVER
10 ILS ANTENNA
11 R-89B/ARN-5A ILS RECEIVER
12 168-71021 RADIO JUNCTION BOX
13 M-299 ADAPTER
14 168-71019 RADIO COMPASS CONTROL BOX
15 PE-94-C DYNAMOTOR UNIT
16 R-5A/ARN-7 RADIO COMPASS RECEIVER
17 88-71719-5 MARKER BEACON ANTENNA
18 168-71012 COMMAND SET CONTROL PANEL
19 168-71016 ILS CONTROL PANEL
20 168-71012-10 COMMAND SET CONTROL PANEL
21 168-71016-10 ILS CONTROL PANEL
22 168-71014 INTERPHONE CONTROL PANEL
23 CONTROL TRANSFER PANEL
24 SCR-522 ANTENNA MAST

168-71-468B

Figure 4-63. Electronic Equipment Location - Airplanes AF49-2897 Through AF49-2981



[O] EQUIPMENT MARKED THUS NOT INSTALLED; TO BE INSTALLED BY TACTICAL SERVICE.

1 168-71019 RADIO COMPASS CONTROL BOX
2 I-101-D INDICATOR
3 AN3157-4 MARKER BEACON LIGHT ASSEMBLY
4 I-81-A RADIO COMPASS INDICATOR
5 778-4B A-C INVERTER (RADIO COMPASS)
6 BC-625-AM TRANSMITTER AND BC-624-A COMMAND RECEIVER
7 BC-1033-B MARKER BEACON RECEIVER
8 COMPASS SENSE ANTENNA
9 BC-733-D ILS RECEIVER
10 ILS ANTENNA
11 R-89B/ARN-5A ILS RECEIVER
12 168-71021 RADIO JUNCTION BOX
13 M-299 ADAPTER
14 168-71019 RADIO COMPASS CONTROL BOX
15 PE-94-C DYNAMOTOR UNIT
16 R-5A/ARN-7 RADIO COMPASS RECEIVER
17 88-71719-5 MARKER BEACON ANTENNA
18 168-71061 COMMAND SET CONTROL PANEL
19 168-71063 ILS CONTROL PANEL
20 168-71061-10 COMMAND SET CONTROL PANEL
21 168-71063-10 ILS CONTROL PANEL
22 168-71014 INTERPHONE CONTROL PANEL
23 FL-30 RANGE FILTER
24 SCR-522 ANTENNA MAST
25 LP-21-LM RADIO COMPASS LOOP ANTENNA

Figure 4-63A. Electronic Equipment Location - Airplanes AF49-2982 Through AF49-3537

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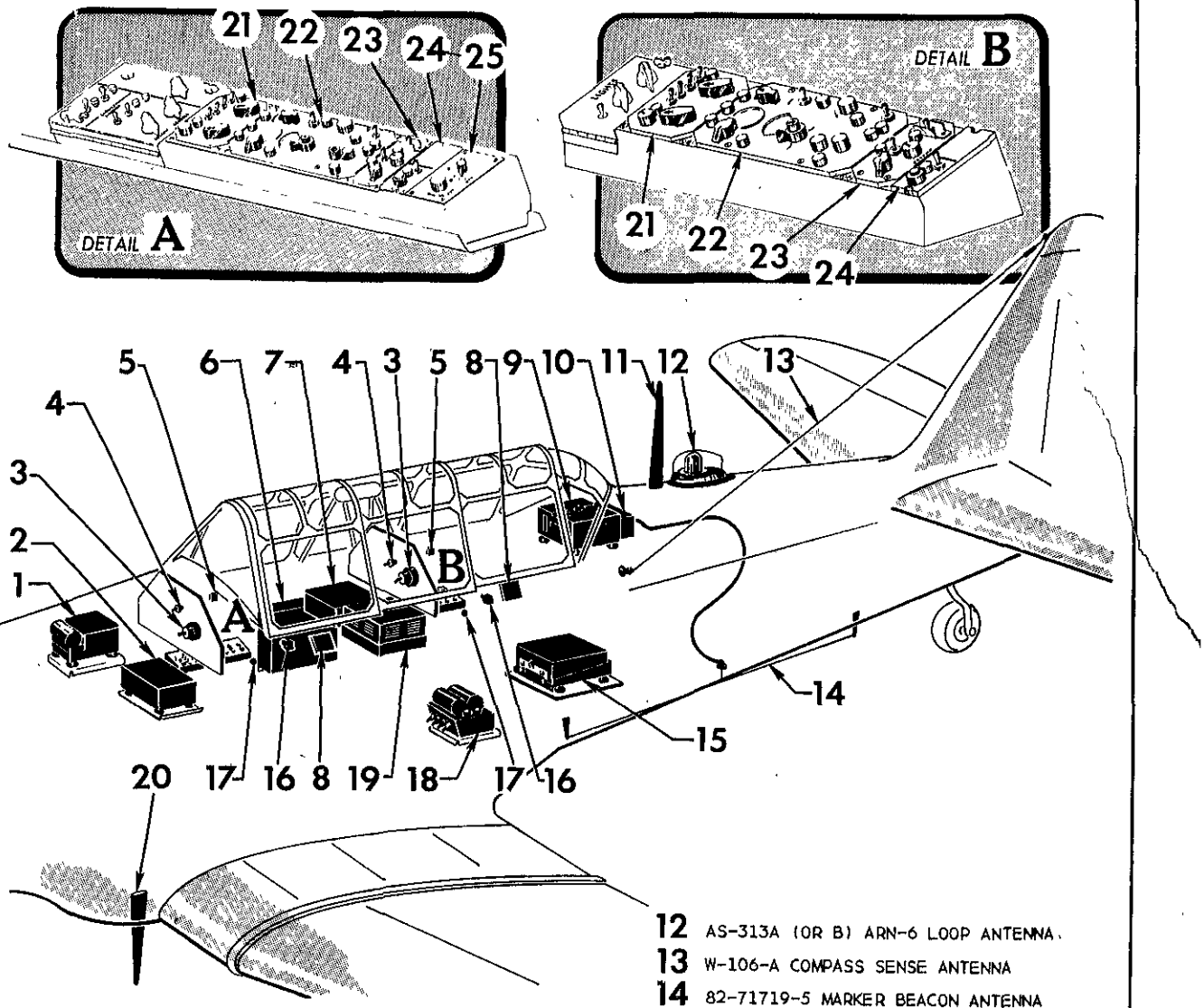
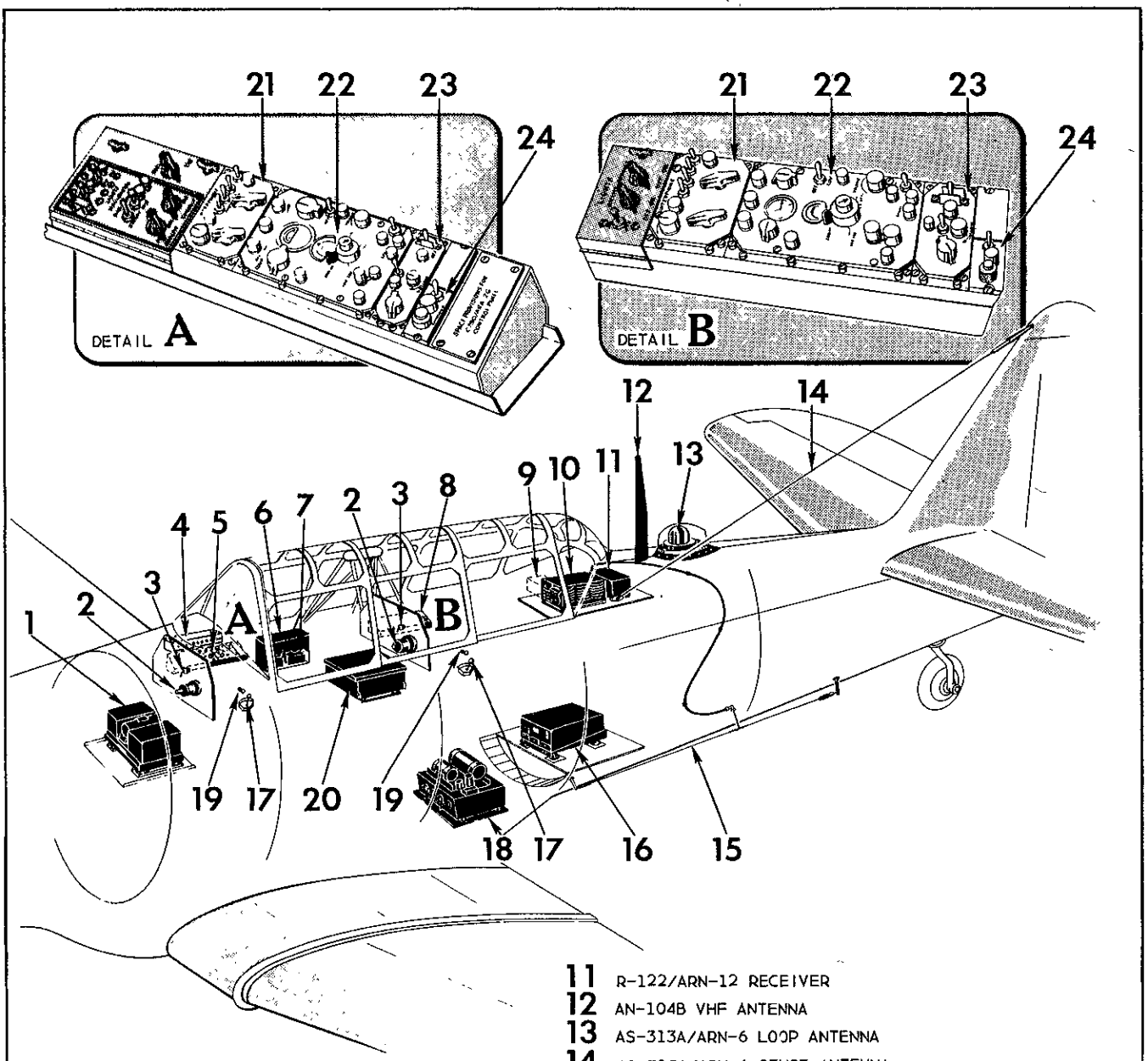


1 AM-300/AIC INTERPHONE AMPLIFIER
2 PE-94-C DYNAMOTOR UNIT
3 ID-90/ARN RADIO COMPASS INDICATOR
4 MARKER BEACON INDICATOR LIGHT
5 HEADSET AND MIKE JACK
6 168-71078 RADIO JUNCTION BOX
7 R-77A/ARC-3 RECEIVER
8 159-71055 FREQ CARD HOLDER (TYPICAL BOTH COCKPITS)
9 SCR-522 SPECIAL RADIO SET
10 BC-1033-B MARKER BEACON RECEIVER
11 AN-104-B ANTENNA MAST (AN/ARC-3)
12 AS-313A (OR B) ARN-6 LOOP ANTENNA
13 W-106-A COMPASS SENSE ANTENNA
14 82-71719-5 MARKER BEACON ANTENNA
15 R-101 A/ARN-6 RADIO COMPASS
16 MIKE SWITCH (THROTTLE QUADRANT)
17 INTERPHONE SWITCH
18 J-68/ARC-3 POWER JUNCTION BOX
19 T-67/ARC-3 TRANSMITTER
20 AN-104-B ANTENNA MAST (SCR-522)
21 C-695/AIC INTERPHONE CONTROL PANEL
22 C-403A/A CONTROL PANEL
23 C-404A/A VHF COMMAND CONTROL PANEL
24 171-71028-11 TRANSFER PANEL
25 168-71077 VHF RADIO PANEL (SCR-522)

168-71-711

Figure 4-63B. Electronic Equipment Location - Airplanes AF49-3538 Through AF49-3596



1 AM-300/AIC INTERPHONE AMPLIFIER
2 ID-90A/ARN-6 RADIO COMPASS INDICATOR
3 AN3157-4 MARKER BEACON INDICATOR
4 182-54027 CIRCUIT BREAKER PANEL
5 FORWARD CONSOLE
6 168-71078-10 JUNCTION BOX
7 AM-142/AIC MIXER AMPLIFIER
8 REAR CONSOLE
9 C-790/ARA-26 KEYER (PROVISIONS ONLY)
10 T-67/ARC-3 TRANSMITTER
11 R-122/ARN-12 RECEIVER
12 AN-104B VHF ANTENNA
13 AS-313A/ARN-6 LOOP ANTENNA
14 AS-315A/ARN-6 SENSE ANTENNA
15 MARKER BEACON ANTENNA
16 R-101/ARN-6 RECEIVER
17 MICROPHONE SWITCH
18 J-68/ARC-3 POWER JUNCTION BOX
19 INTERPHONE SWITCH
20 R-77A/ARC-3 RECEIVER
21 C-695/AIC INTERPHONE CONTROL PANEL
22 C-403A/A (159-71064-7) RADIO COMPASS CONTROL PANEL
23 C-404A/A VHF CONTROL PANEL
24 171-71028-11 TRANSFER CONTROL PANEL

182-71-749

Figure 4-63C. Electronic Equipment Location - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent

4-391. TROUBLE SHOOTING ELECTRONIC EQUIPMENT.

TROUBLE	PROBABLE CAUSE	REMEDY
	BC-625-AM TRANSMITTER	
No meter reading on position 1.	Crystal not oscillating.	Replace crystal.
	Filament of VT-198 or VT-199 diode indicator burned out.	Replace defective tube.
No meter reading on meter position 2.	Second harmonic amplifier VT-118 burned out.	Replace defective tube.
No meter reading on meter position 3.	Power amplifier VT-118 burned out.	Replace defective tube.
Antenna does not load properly.	Transmitter out of adjustment.	Retune transmitter.
	Dirt in antenna relay points or incomplete closing.	Clean and adjust points.
Arcing antenna coupling coil.	Antenna coil coupled too close to final tank coil.	Reduce antenna coupling. Retune transmitter on all channels.
	Foreign matter shorting antenna coil.	Remove foreign matter.
Set remains in the receive position.	Shorted control switch or cable, or points of locking relay 411-1 shorted or stuck together.	Replace control box, if necessary. Check relay points.
Transmitter channel "D" control has no effect.	Terminal 6 on Jones plug 123-1 shorted to ground.	Correct.
	Contactor cable shorted.	Repair or replace.
Transmitter operates, but tone is heard in headset.	Relay 131 points closed in "pip-squeak" position.	Clean points on relay.
	Solenoid shorted to ground.	Replace solenoid.
No modulation when set in the transmit position.	Speech amplifier VT-199 or modulator VT-134 burned out.	Replace defective tube.
	BC-624-A RECEIVER	
Receiver sounds as if it is working, but no signals can heard.	Any of the following tubes may be defective: VT-207, harmonic generator VT-202, or amplifier VT-203. Crystal not oscillating.	Check tubes and replace if defective. Clean or replace crystal.
Crystal good but no signal is heard.	R-F tube VT-203 or mixer tube VT-203 burned out.	Replace defective tube.
	NOTE These are peanut tubes that, when defective, appear cloudy or milky.	
No sidetone.	First audio VT-169 or VT-135 burned out.	Replace defective tube.

TROUBLE	PROBABLE CAUSE	REMEDY
Receiver output low or distorted.	Headsets not matched with output transformer in receiver.	Make sure that headset connections are matched with terminals 4 and 6 on transformer for HS-33 headset.
Audio squelch does not operate.	Tube VT-207 defective.	Replace tube.
	Audio squelch relay not working properly.	Adjust.
	SCR-522-A RACK	
Channel release button does not release.	Cams operate channel slides too fast.	Move entire assembly, or spring the slides that are causing the trouble.
Channel motor erratic.	Interrupter switch points do not have proper gap.	Completely open gap .005 inch or about the thickness of a sheet of writing paper.
	PE-94-C DYNAMOTOR	
Voltage and dynamotor speed varies.	Dynamotor requires adjusting.	Loosen set, and adjust carbon pile for 13.5 volts on low-voltage output and steady dynamotor speed.
Noisy dynamotor.	Dirty commutator, faulty brushes, and brushes binding in their holders.	Clean commutator or replace brushes.
	BC-1033-B RADIO RECEIVER	
Indicator light does not operate, and tubes are cold.	Power cable is open, one of the tubes has an open filament, or relay is defective.	Check for correct voltage at plug PL-108 and test tubes. Replace or repair defective items.
Indicator light does not operate, and tubes are warm.	Burned-out indicator light, open light cable, defective tube, or defective relay.	Check items, and replace or repair those proved defective.
	R-89B/ARN-5A RECEIVER	
Receiver tubes do not light.	Power switch not turned on.	Turn power switch on.
	Defective fuse in junction box.	Change fuse.
Fuse continues to blow.	Short in connecting cables, junction box, or control box.	Locate and repair short.
	Short at the 28-volt input connections of receiver.	Locate and repair short in 28-volt input circuit.
No r-f signal.	Intermittent or defective crystal.	Change crystal.
	Defective mixer, first i-f amp, second i-f amp, third i-f amp, third doubler, fourth doubler, or oscillator tubes.	Change defective tube or tubes.
No course sensitivity.	Defective detector and avc, first a-f amp, or second a-f amp tubes.	Change defective tube or tubes.

TROUBLE	PROBABLE CAUSE	REMEDY
	Defective indicator I-101-C.	Change indicator.
No indicator reading.	Defective indicator I-101-C.	Change indicator.
	Defective first a-f amp tube.	Change tube.
Tubes do not light.	Fuse blown.	Change fuse.
	Short in connecting cables.	Locate and repair short.
	Defective first i-f amp, second i-f amp, or third i-f amp tubes.	Change defective tube or tubes.
	Defective mixer, tripler, or fourth doubler tubes.	Change defective tube or tubes.
	Defective first a-f amp and oscillator tubes.	Change defective tube or tubes.
	Defective detector and avc, or second a-f amp tubes.	Change defective tube or tubes.

BC-733-DD RECEIVER

CAUTION

When trouble develops in either receiver or dynamotor that requires a unit replacement, the complete receiver and dynamotor will be returned for repair and a new BC-733-DD complete unit will be used as a replacement since these units are matched and should not be separated.

No filament voltage; dynamotor does not start.	Blown fuse in junction box or circuit breaker open.	Replace fuse or close circuit breaker.
	Loose plug.	Tighten plug.
	Open cable.	Repair break in cable.
	Switch on radio control box defective.	Replace control box.
	Battery dead or disconnected.	Replace or connect battery as required.
Dynamotor does not start, but filament voltage is correct.	Open circuit at the low-voltage brushes.	Repair open circuit.
	Low-voltage commutator dirty.	Clean commutator.
	Defective brushes in low-voltage commutator.	Replace brushes.
Primary circuit of dynamotor is normal, but will not run, and blows fuses.	Short circuit between B+ and ground.	Eliminate short circuit.
	Defective dynamotor armature.	Replace complete receiver and dynamotor units because these are matched units.
No B+ on r-f stages, but dynamotor runs properly.	Internal short in dynamotor.	Replace complete receiver and dynamotor.
	Open circuit in dynamotor high-voltage system.	Replace complete receiver and dynamotor.

TROUBLE	PROBABLE CAUSE	REMEDY
Receiver oscillates.	R-f or first detector tubes faulty.	Replace defective tube or tubes.
	Loose ground lug, or broken wire connecting tube shields to chassis.	Tighten loose lug and/or repair broken wire.
Receiver operates but is insensitive.	Low primary voltage.	Correct input to 28 volts dc.
	Faulty tube.	Replace tube.
	Faulty volume control on radio control box.	Replace radio control box.
	Set out of alignment.	Remove set and dynamotor for bench check and realignment.
Indicator I-101-C operates but no audio output.	Audio output tube faulty.	Replace audio output tube.
	Volume control on control box faulty.	Replace control box.
	Loose connection in headset cord and plug.	Tighten loose connection.
	Loose connection or broken wire in junction box.	Tighten loose connection or repair broken wire.
Audio output, but indicator I-101-C does not work.	Visual channel tube faulty.	Replace tube.
	Open in wiring of cord or junction box.	Repair broken wire.
	Faulty indicator.	Replace indicator.
	Balance of sensitivity controls faulty.	Replace.

T-67/ARC-3 TRANSMITTER

WARNING

Turn off all power before attempting to service the equipment, as the high voltage can cause serious injury to personnel.

Transmission but no sidetone; tuning system stops at proper frequency.	Dirty contacts on relay K-406.	Clean contacts.
No modulation or sidetone; tuning system stops at proper frequency.	Defective V-106 or V-109 tube, or dirty contacts on relay K-106.	Replace defective tube or clean relay contacts.
No transmission or sidetone; tuning system stops at high-frequency end.	Defective crystal, defective tube V-101, V-102, V-103, V-104, V-107, V-108, or dirty contacts on crystal relay.	Replace crystal. Replace defective tube, or clean contacts of relay.
No transmission; motor does stop.	Burned-out transmitter fuse in power junction box.	Replace fuse.
	Defective tube V-105.	Replace.
	Dirty relay contacts on K-102.	Clean contacts.
	Dirty contacts on power junction box relays K-403 and K-404.	Clean contacts.

TROUBLE	PROBABLE CAUSE	REMEDY
No transmission; dynamotor does not stop.	Low battery or external battery source.	Charge battery.
	Defective plug in relay K-103.	Replace.
	Dirty relay contacts on K-104.	Clean contacts.
No transmission; dynamotor does not run.	Dirty contacts on relay K-106, or K-104.	Clean contacts.
	Dirty contacts on relay K-402 in power junction box.	Clean contacts.
No transmission; motor does not start.	With cover removed, button S-102 not pushed.	Push button S-102.
	Circuit breakers open.	Reset breakers.
	Dirty circuit breaker connections.	Clean and tighten connections.
	Dirty crystal relay contacts.	Clean contacts.
	Dirty contacts on relays K-104, K-107, and K-108.	Clean contacts.
Intermittent operation.	Broken coaxial cable connection to antenna assembly.	Repair coaxial cable connection.
Transmitter tunes to "end" and will not release from that position.	"OFF" button on control panel or battery switch pushed while set was cycling.	Place channel selector switch to "A" channel and wait until cycling is completed; then place on-off switch to "OFF" before placing battery switch in "OFF" position.
	R-77A/ARC-3 RECEIVER	
No reception; tuning system stops at proper frequency.	Defective tubes.	Replace defective tubes.
	Dirty relay contacts on relay K-406.	Clean contacts.
Receiver goes to high end of band, or does not stop.	Low battery or external power source.	Charge battery.
No reception; tuning system stops at high-frequency end of band.	Defective crystal.	Replace crystal.
	Defective tube or tubes.	Replace tubes as necessary.
	Dirty contacts on crystal relay or on relays K-204 or K-205.	Clean contacts.
No reception; tuning system stops at wrong frequency.	Incorrect setting of the thumbwheel for inoperative channel.	Make proper correction of thumbwheel setting.
	Dirty crystal relay contacts.	Clean contacts.
	Dirty contacts on relay K-204 or K-205.	Clean contacts of relay K-204 or K-205.
No reception; motor will not stop.	Blown receiver fuse (on power junction box).	Replace fuse.

TROUBLE	PROBABLE CAUSE	REMEDY
	Defective V-207 or V-210 tube.	Replace tubes.
	Dirty relay contacts on relays K-404 and K-405 in power junction box.	Clean contacts.
	Defective plug in relay K-102.	Replace plug.
	Dynamotor brushes worn.	Replace.
Dynamotor will not run and blows fuses.	Short circuit between positive lead and ground.	Repair short.
	Defective dynamotor armature.	Replace dynamotor.
No positive voltage on r-f stages, but dynamotor runs properly.	Internal short or open circuit in dynamotor high-voltage system.	Replace dynamotor.
Receiver oscillates.	Faulty r-f or first detector tube.	Replace defective tube or tubes.
	Loose ground or open ground lead from tube shield to chassis.	Tighten or repair as required.
Receiver operates but is not sensitive.	Low primary voltage.	Raise voltage.
	Faulty tube or tubes.	Replace tubes.
	Set out of alignment.	Replace receiver.
	Defective volume control on control panel.	Replace control panel.
	USAF COMBAT INTERPHONE	
No output on interphone; all other radio equipment operating satisfactorily.	Open circuit breaker.	Reset breaker.
	Defective dynamotor unit on AM-300/AIC amplifier.	Replace dynamotor unit.
	Defective tube.	Replace.
	Defective interphone amplifier AM-300/AIC.	Replace amplifier.
Intermittent output of interphone and radio facilities.	Intermittent short circuit or open circuit in headset or headset extension cord.	Repair short or open circuit.
Intermittent output when range filter is used.	Defective filter F-21/ARA-9.	Replace filter.
Gain of interphone amplifier AM-300/AIC does not change with changes in altitude.	Defective automatic gain control C-158/AIC inside amplifier.	Replace interphone amplifier.
No radio facilities output on "COMMAND AND MIXED SIGNALS" position of control panel C-695/AIC.	Defective mixer-amplifier AM-142/AIC.	Replace amplifier.

4-392. MAINTAINING ELECTRONIC EQUIPMENT.

4-393. The only maintenance requirements are checking the battery voltage, testing tubes, and checking wiring and connections. Do not attempt to service any item of electronic equipment unless suitable shop and testing facilities are available.

NOTE

Proper operation of electronic equipment is dependent upon keeping to a minimum the radio interference produced within the airplane. Therefore, if any electrical or electronic equipment is changed, care must be taken to ensure interference-free operation to the electronic receiving equipment.

4-394. SCR-522-A COMMAND SET.

4-395. The SCR-522-A command set (figure 4-63), consisting primarily of a receiver (BC-624-A), transmitter (BC-625-AM), dynamotor (PE-94-C), control panel (168-71012), change-over relay (Advance 6213A), and antenna (AN104-B), is used for two-way radiophone communication between airplanes in flight and between airplanes and ground station. The receiver and transmitter will operate on any one of four crystal-controlled channels within the frequency range of 100 to 156 megacycles. On Airplanes AF49-2897 through AF49-2981, transfer of control from either console panel is made through the transfer switch panel on the right-hand panel in aft cockpit. On Airplanes AF49-2982 through AF49-3537, transfer of control from either cockpit is accomplished by closing a switch on either control panel. The transfer action is made by two relays mounted on the aft end of the radio junction box. Antenna change-over is accomplished by a relay incorporated in the transmitter-receiver. The filaments and relay circuits operate on 28-volt dc, while the plate power is furnished by a dynamotor mounted below the receiver. Power consumed during transmission is 11.5 amperes. There is an input current of 11.1 amperes during receiving period. On Airplanes AF49-2982 through AF49-3537, an FL-30 range filter unit is mounted slightly aft of the console in each cockpit. The a-f amplifier portion of the receiver is used as the interphone system. (Refer to paragraph 4-414 for information on the interphone system.) Average output of transmitter is between 8 and 9 watts. On Airplanes AF49-2982 through AF49-3537, the transmitter circuit is wired so that when the switch on the control panel is closed, a modulated tone is transmitted for use in directional finding operations. The circuit is protected by a 20-ampere breaker on the front cockpit right-hand console. A resistor has been connected in the receiver audio system to permit good output to headphones when volume control is in full "OFF" position. The receiver output transformer has been changed from high to low impedance. On Airplanes AF49-3538 through AF49-3596 (figure 4-63B), the SCR-522-A command set is controlled from one control panel in the front cockpit only. However, it can be used from either cockpit for airplane-to-ground vhf communications. The a-f amplifier in the receiver portion of the command set is not used for interphone service. The range filters, F-21/ARA-9, are located in the radio junction box aft of the right-hand forward console.

4-395A. ALTERNATE SCR-522-A COMMAND SET INSTALLATION.

4-395B. The SCR-522-A command set is substituted for the AN/ARC-3 vhf command set on Airplanes AF51-14350 through AF51-14683. These airplanes include complete wiring and mounting provisions for future installation of the AN/ARC-3 vhf command set. When the AN/ARC-3 vhf command set is installed, all SCR-522-A equipment, including wiring, should be removed. The temporary SCR-522-A command set installation differs from the SCR-522-A as described in paragraph 4-395 in the control panels only. The BC-602 control panel and the transfer control panel (171-71028-11) differs from the 168-71012 control panel in the following ways:

a. The transfer control panel transfer switch (171-71028-11) is a toggle switch; the transfer switch (168-71012) is a rotary switch.

b. The channel selector switch (BC-602) is a push-button switch; the channel selector switch (168-71012) is a rotary switch.

4-396. OPERATIONAL CHECK OF SCR-522-A RADIO SET (AIRPLANES AF49-2897 THROUGH AF49-3537). To check out SCR-522-A equipment, proceed as follows:

NOTE

Prior to take-off, make certain that all plugs and cable leads are properly connected. Use an external power source when checking radio set. If battery in airplane is used, do not operate equipment any longer than necessary.

a. Turn "VOL" control on right-hand console clockwise to turn equipment on.

b. From the rear cockpit right-hand console panel, transfer control to control panel from which the equipment will be operated.

NOTE

If the airplane is going to be flown solo, make certain the control of SCR-522-A equipment has been shifted to the front cockpit.

c. Place channel selector switch to channel desired. Channels are as follows:

CHANNEL	RECEIVER CRYSTAL	TRANSMITTER CRYSTAL	OPERATING FREQUENCY
A	8200.00 kc		135.00 mc
		7550.00 kc	135.90 mc
B	8155.71 kc	7010.00 kc	126.18 mc
C	8392.00 kc	7660.00 kc	137.88 mc
D	8423.08 kc	6750.00 kc	121.50 mc

d. Allow approximately one minute for vacuum tubes to warm up.

e. Press the button on throttle quadrant, and speak into microphone.

f. To receive, release button.

g. Repeat procedures a. through e. for all four channels from each cockpit.

h. After check is made and equipment is found to be in good operating order, turn "VOL" control to "OFF" position.

WARNING

Never shut off the equipment with the shifter slides disengaged, as this will result in failure to turn on the transmitter and receiver if one channel is selected through selector switch.

4-396A. OPERATIONAL CHECK OF SCR-522-A RADIO SET (AIRPLANES AF49-3538 THROUGH AF49-3596). To check out SCR-522-A equipment, proceed as follows:

a. Turn "VOL" control on right-hand console of front cockpit clockwise to turn equipment on. (Equipment is controllable from front cockpit only.)

b. Place interphone control panel selector switch on "SPECIAL RADIO," and adjust volume control as required.

c. Place selector switch to channel A. Channel A frequencies are as follows:

RECEIVER CRYSTAL	TRANSMITTER CRYSTAL	OPERATING FREQUENCY
8036.25 dc	7810.00 kc	140.58 mc

d. Proceed with steps d. through h. of paragraph 4-396.

4-397. REMOVING BC-624-A RECEIVER AND BC-625-AM TRANSMITTER UNIT. Remove equipment in the following manner:

a. Make sure equipment is turned off.

b. Slide set forward slightly; then remove power plugs, antenna, and ground.

c. Unfasten dzus fasteners that secure transmitter-receiver unit to mounting.

d. Lift set off mounting.

NOTE

The dynamotor unit is removed in the same manner, with the exception that the rear seat must be removed.

4-398. INSTALLING BC-624-A RECEIVER AND BC-625-AM TRANSMITTER UNIT. Install equipment in the following manner:

a. Set equipment on mounting and secure in place with dzus fasteners.

b. Connect power plugs, antenna, and ground connections.

c. Check equipment for proper operation according to paragraph 4-396 or 4-396A.

4-398A. AN/ARC-3 VHF COMMAND SET.

4-398B. Command set AN/ARC-3 on Airplanes AF49-3538 through AF49-3596, AF51-14314 through AF51-15137, and AF51-17354 and subsequent (figures 4-63B and 4-63C) is air-borne receiving and transmitting equipment, designed to provide "VOICE" and "MCW" plane-to-plane or plane-to-ground communication. It is comprised of the following major assemblies: Transmitter (T-67/ARC-3), receiver (R-77A/ARC-3), power junction box (J-68/ARC-3) with dynamotor units (DY21/ARC-3 and DY22/ARC-3), control panel (C-404a/a), and antenna mast (AN-104B). The transmitter contains nine tubes and provides a crystal-controlled r-f power output of 8 watts on any of eight pre-selected channels. When using voice modulation, the carrier can be modulated approximately 85 percent. The carrier can be modulated approximately 75 percent when using tone modulation. The various channels are automatically selected by an electrically operated, channel-selecting mechanism when any one channel (designated "A" through "H" on the control panel) is selected. Transmitter and receiver channels for each frequency are selected simultaneously. The receiver is 17-tube, crystal-controlled, superhetrodyne. The method of channel selection is the same as for the transmitter. Audio output of receivers is fed directly to the interphone system. The power junction box contains dynamotor units (DY-21/ARC-3 and DY-22/ARC-3), which supply the high voltage for operation of the transmitter and receiver, respectively. The junction box also contains fuses for each dynamotor circuit and serves as the junction point for all interconnecting cables between the receiver, transmitter, power source, and control panels. The control panels provide facilities for complete control and operation of command set AN/ARC-3 from the forward and rear cockpits.

4-398C. REMOVING T-67/ARC-3 TRANSMITTER AND R-77A/ARC-3 RECEIVER. To remove the transmitter and receiver, proceed as follows:

a. Remove safety wire and slide the snap slides free of tie-down lugs on both transmitter and receiver.

b. Disconnect plugs and antenna cables from both sets.

c. Lift each unit off mounting bracket into rear cockpit area.

4-398D. INSTALLING T-67/ARC-3 TRANSMITTER AND R-77A/ARC-3 RECEIVER. To install transmitter and receiver, proceed as follows:

a. Place each unit on proper mounting bracket.

b. Slide the snap slides on tie-down lugs and safety-wire snap slides.

c. Connect plugs and antenna cables to both sets.

4-398E. OPERATIONAL CHECK OF AN/ARC-3 COMMAND EQUIPMENT. To check AN/ARC-3 command equipment, proceed as follows:

a. Turn battery-disconnect switch "ON," or connect an external power source to airplane.

b. Insert headset and microphone into respective extension cord jacks stowed beneath the seats.

c. Start equipment by selecting any one of the eight channels on the C-404A/A control panel. This action turns on transmitter and receiver, which then automatically tune to the selected channel.

d. Turn the function switch on interphone control panel to "COMMAND AND MIXED SIGNAL" position.

e. Allow 30 to 45 seconds for tubes in equipment to reach operating temperature. During latter portion of this warm-up period, an audio tone will be heard in the headset. When this tone stops, receiver and transmitter have been tuned to the selected channel; receiver output should be heard in headset immediately afterward.

f. Push press-to-talk button "MIC" on throttle lever and speak into microphone. Speech (sidetone) which modulates the transmitter should be audible in headset. If none is heard, make sure the proper crystal has been

inserted for that channel of the transmitter. Release press-to-talk button to restore receiver operation.

g. Establish two-way radio communication with control tower on field as a final check on operation of the equipment.

h. Adjust squelch control for desired background noise level consistent with operating conditions. (Refer to paragraph 4-398F.)

i. Check the "MCW" operation by pressing "D/F TONE" button on control panel.

j. Select each of the other set-up channels, and check operation of each as stated in procedures d. through h.

NOTE

The transmitter and receiver tune to selected channels simultaneously. Approximately 2 seconds is required to select channels. An audio tone will be heard in headset while equipment is tuning.

k. Turn equipment off by moving the toggle switch on right side of control panel to "OFF" position.

NOTE

If either receiver or transmitter has tuned incorrectly, select any other channel and then select desired channel again. Repeated mistuning indicates a defective crystal, incorrect setting of thumbwheels, or other defects in the equipment.

4-398F. ADJUSTING AUDIO SQUELCH CONTROL. Background noise in receiver may be reduced effectively by the audio squelch control, which is adjustable. Access for screwdriver adjustment of squelch circuit control is provided by the sliding cover marked "SQUELCH," located just to the right of the frequency indicating dial on front panel. Adjust squelch circuit as follows:

a. Rotate control shaft in a counterclockwise direction to increase squelch action. Increasing squelch action decreases background noise level and, at the same time, requires a stronger signal to "trip" the squelch action and permit normal reception.

b. To decrease squelch action, rotate control shaft in a clockwise direction. Decreasing squelch action increases background noise level, and also increases receiver sensitivity to weak signals.

NOTE

Set squelch action no higher than necessary to reduce background noise to a tolerable level, as an increase in squelch action also prevents signal reception.

4-398G. TESTING T-67/ARC-3 TRANSMITTER. To test T-67/ARC-3 transmitter, proceed as follows:

NOTE

When lid of transmitter is removed, depress motor control switch S-102 while selecting channels, to ensure proper operation.

a. Connect phantom transmitter antenna TS-78/U to the receptacle marked "ANTENNA" on front of transmitter.

b. Connect microphone to the proper jack.

c. Connect test unit TS-178/ARM-1 to receptacle marked "PL-152" on front of transmitter, and turn to "A+" position. The cable between junction box (dynamotor unit) and receiver is not needed for this test.

d. Insert crystal units of the following frequencies:

CHANNEL	CRYSTAL FREQUENCY	TRANSMITTING FREQUENCY
A	7550 kc	135.90 mc
B	7010 kc	126.18 mc
C	7660 kc	137.88 mc
D	6750 kc	121.50 mc
G	7600 kc	136.80 mc
H	7450 kc	134.10 mc

e. Set channels E and F on frequencies that will be used in the airplane.

f. Select channel A on control panel C-404A/A. If tuning motor does not stop after one minute, turn switch of test unit TS-178/ARM-1 to "B" position. If no voltage is indicated, check transmitter high-voltage fuse on power junction box J-68/ARC-3. If motor stops but no power output is obtained, as shown in lamps of phantom antenna TS-78/U, it will be necessary to check crystal unit and vacuum tubes. All tubes except JAN-832-A may be replaced without realignment. Instructions for check of the alignment after replacing a JAN-832-A tube are printed in lid of transmitter.

g. Check modulation of transmitter by noting an increase in brightness of lamps in phantom antenna TS-78/U when speaking into microphone.

h. The readings as observed on test unit TS-178/ARM-1 should be within the following limits when push-to-talk button is depressed.

POSITION	LIMITS
Osc	More than 20
1	More than 25
2	More than 25
3	More than 25
4 Trans.	40 to 85

If readings on positions 1, 2, 3, and 4 Trans. are not within these limits, a change of tubes or realignment is indicated. Make sure power source is between 27 and 29 volts before replacing tubes or attempting to realign the set. A reading of 54 to 58 on the A+ scale of test unit TS-178/ARM-1 indicates a satisfactory voltage.

i. Check channels B, C, and D. Check meter readings in the positions indicated in procedure h. Check for power output on the remaining five channels. The antenna loading is adjusted at the factory for an average value that will give the best results regardless of frequency used. This antenna loading adjustment should not be changed.

j. Remove test crystals and insert proper crystals for the installations.

NOTE

Absence of power output on one or two channels is usually caused by defective crystal units or dirty relay contacts. The phantom antenna TS-78/U indicates only relative power output at a particular frequency. More or less light, as indicated by lamps of this phantom antenna, on another frequency does not necessarily mean a change in power output.

4-398H. TESTING R-77A/ARC-3 RECEIVER. To test R-77A/ARC-3 receiver, proceed as follows:

NOTE

When lid of receiver is removed, switch S-203 must be depressed while selecting channels to secure proper operation. Hold switch until tuning motor stops running.

a. Connect test unit TS-178/ARM-1 to socket PL-152, which is located under cover on right side of receiver, and set at "A+" position. Connect headphones to their proper receptacle.

b. Insert crystal units and set receiver thumbwheels on channels listed.

CHANNEL	CRYSTAL FREQUENCY	THUMBWHEEL
A	8200.00 kc	135.00
B	8155.71 kc	126.18
C	8392.00 kc	137.88
D	8423.08 kc	121.50
G	8320.00 kc	136.80
H	8140.00 kc	134.10

c. Set channels E and F on frequencies that will be used in airplane.

d. Select channel A on control panel C-404A/A. If motor does not stop in about one minute, turn switch to test unit TS-178/ARM-1 to "B" position. If no voltage is indicated, check transmitter high-voltage fuse on power junction box J-68/ARC-3. The frequency indicating dial at extreme right of receiver should stop at 140.58 megacycles plus or minus one percent. If word "END" appears, select channel B and immediately return to channel A. Switch S-203 must be depressed during shifting operations. If the word "END" appears this time, the crystal unit and tubes should be checked. It is not necessary to make any alignment adjustments after replacing any of the receiver tubes.

e. The meter reading in switch position 1 of test unit TS-178/ARM-1 on channel A should be between 40 and 60.

f. Select channel B. Meter position 1 should read more than 8, and position 3 more than 25.

g. Select channel C. Meter position 1 should read more than 8, and position 2 more than 5.

h. Select channel D. Meter position 3 should read more than 30.

i. Remove test unit TS-178/ARM-1 and replace receiver cover. Check to see that squelch is full off.

j. Check intermediate frequency and audio stages by listening in phones for a hiss, which indicates that receiver is operating. The antenna connection may be tapped gently with a metallic object. A click should be heard in headset, indicating proper operation of receiver.

k. Check remaining four channels to make sure receiver tunes to frequency determined by crystal unit and proper setting of thumbwheel.

NOTE

If signal generator I-130A (part of test equipment IE-19A) is available, it can be used to compare a questionable receiver with one known to be in good operating condition. Crystal control of this signal generator, using a transmitter crystal, should be used. Entirely acceptable receivers may have a variation in sensitivity for a given frequency of three to one from receiver to receiver. This fact should be kept in mind to avoid rejecting usable receivers.

l. When questionable, burnish relay contacts with tool provided in radio test set AN/ARM-1. Never burnish relay contacts with an abrasive tool such as a file.

4-399. AN/ARN-7 RADIO COMPASS.

4-400. The AN/ARN-7 radio compass system (figure 4-63) consists of a receiver, two control boxes, two indicators, a relay, a loop antenna, a sense antenna, and an inverter. The equipment, used as a navigational instrument, is basically a superheterodyne-type receiver with circuits adapting it for radio compass

operation. The receiver frequency range covers in four bands from 100 kilocycles to 1750 kilocycles. Tuning the receiver from either cockpit is accomplished mechanically through tuning shafts connected into the two control panels. The equipment is powered from two sources; 115-volt, 400-cycle, a-c inverter for receiver operation; and 28-volt dc for operation of the control relays and band switch mechanism. The d-c system is protected by a 35-ampere circuit breaker on the right console in the front cockpit; a 3-ampere fuse, in the radio junction box and accessible from the cockpit, protects the a-c powered circuits.

4-401. ADJUSTING R-5A/ARN-7 RADIO COMPASS RECEIVER AUTOMATIC SENSITIVITY. To adjust compass receiver automatic sensitivity, proceed as follows:

a. Turn the "AUTO SENS-THRES SENS" cover plate to one side for access to the adjusting screws.

b. Tune the radio compass receiver to a station 10 miles or more away.

c. Turn the remote-control switch to "COMP" and note the bearing indication. With a screwdriver, adjust the automatic sensitivity adjustment screw for minimum hunting of the bearing indicator pointer about the indicated bearing position.

d. Turn the remote control switch to "LOOP," and rotate the loop until the indicator pointer is one degree from the previously noted bearing indication.

4-402. ADJUSTING R-5A/ARN-7 RADIO COMPASS RECEIVER THRESHOLD SENSITIVITY. To adjust compass receiver threshold sensitivity, proceed as follows:

a. Turn the "AUTO SENS-THRES SENS" cover plate for access to the adjusting screws.

b. Turn the function selector switch, on the control panel, to "ANT" position, and turn the "VOLUME" knob to its maximum clockwise position.

c. Set the band selector switch on the center band, and then tune the compass receiver to a point near the middle of the dial where no signal is heard.

d. With the airplane engine running, adjust the threshold sensitivity screw to reduce the noise until it is appreciable, but not objectionable.

e. Tune the radio compass throughout its frequency to make sure that the sensitivity has not been too greatly reduced.

4-403. OPERATIONAL CHECK OF AN/ARN-7 RADIO COMPASS. To check AN/ARN-7 radio compass, make the following tests from each control panel:

a. Turn the function selector switch to "COMP" position.

b. After a 5-minute warm-up period, hold function selector switch in "CONT" position, and ascertain that control of the equipment is transferred to the panel being operated.

c. Tune the receiver to a station on each band, and note that the indicators establish a definite bearing as each station is tuned in.

d. Operate the "VOLUME" control, and check for proper control of headset volume.

e. Operate the "CW VOICE" switch at each frequency and determine its proper operation by listening for the 800-cycle tone.

f. Move the function selector switch to "ANT" position, and tune to stations received in step c., while listening on headset for satisfactory reception from each station.

g. During one of the observations in step f., operate the "CW VOICE" switch to "CW" position, and check for an audio tone having variable frequency as station is tuned in.

h. With a station tuned in, change the function selector switch to "LOOP" position and, using the "LR" switch, rotate the loop through 360 degrees. The action of both indicators should be smooth while the loop is being rotated. Adjust "AUTO SENS" control, on front of receiver, to obtain the desired amount of hunting of the indicator about the indicated bearing position. However, maintain enough sensitivity so that when the loop is rotated one degree from its bearing position, the automatic control circuits will restore it to within 0.5 degree of the original bearing position.

i. Turn function selector switch to "OFF" position.

4-404. REMOVING R-5A/ARN-7 RADIO COMPASS RECEIVER. Remove the radio compass receiver in the following manner:

a. Remove the rear pilot's seat.

b. Remove antenna and ground connections.

c. Remove power plug from receiver.

d. Release receiver from mounting by means of wing.

e. Lift receiver off mounting.

4-405. INSTALLING R-5A/ARN-7 RADIO COMPASS RECEIVER. Install radio compass receiver in the following manner:

a. Place receiver on mounting, and secure in place with wing nuts.

b. Connect antenna and ground connections.

c. Connect power plug from receiver.

d. Install the seat.

e. Make operational checkout.

4-405A. AN/ARN-6 RADIO COMPASS.

4-405B. The AN/ARN-6 radio compass is installed on Airplanes AF49-3538 through AF49-3596, AF51-14314 through AF51-15137, and AF51-17354 and subsequent. This navigational equipment automatically indicates the direction of any desired station, when the radio compass is set for compass operation. The equipment consists of the R-101A/ARN-6 receiver, the AS-313A/ARN-6 compass loop antenna, the AS-315A/ARN-6 compass sense antenna (Airplanes AF51--14314 through AF51-15137, and AF51-17354 and subsequent) and W-106-A compass sense antenna (Airplanes AF49-3538 through AF49-3596), the C-403A/A control panels, and the ID-90/ARN or ID-90A/ARN indicators. The R-101A/ARN-6 receiver covers the frequency range from 100 kilocycles to 1750 kilocycles in steps of four bands. Primary power for the receiver is supplied by the electrical system of the airplane. A vibrator and filter circuit within the receiver provides the high voltage for the receiver.

4-405C. REMOVING R-101A/ARN-6 RECEIVER. To remove radio compass receiver, proceed as follows:

a. Disconnect antennas, tuning shaft, ground, and power plugs from receiver.

b. Break safety wire on thumb nuts, and loosen thumb nuts until they fall free of hold-down lugs.

c. Pull receiver forward slightly to disengage tapered pins at rear of receiver.

d. Lift receiver clear of mounting bracket.

4-405D. INSTALLING R-101A/ARN-6 RECEIVER. To install radio compass receiver, proceed as follows:

a. Position receiver on mounting bracket.

b. Push receiver aft slightly to make sure tapered pins at rear of receiver are correctly engaged.

c. Position thumb nuts over hold-down lugs, and tighten. Secure thumb nuts with safety wire.

d. Connect antennas, tuning shaft, ground, and power plugs to the receiver.

e. Make operational check of receiver.

4-405E. OPERATIONAL CHECK OF AN/ARN-6 RADIO COMPASS. To check out system, proceed as follows:

a. Connect an external source of power to airplane.

b. Turn function switch on control panel to "COMP."

c. Using headset, check operation of "VOLUME" control to make sure that it properly controls the headset volume.

d. While listening, jar radio compass receiver to check for possible noise or intermittent reception.

e. Place function switch in "ANT" position, and check operation of equipment on all four bands. Switch "CW VOICE" switch to "CW," and check operation of the beat frequency oscillator.

f. Switch to "LOOP" and check operation on all bands. Check operation of "LOOP L-R" switch against the actual direction and speed of loop rotation, as indicated by the indicator pointer.

g. Park airplane in an area at least 200 feet away from metallic frame buildings, hills, power lines, railroads, or other large electrically conductive objects. Swing heading of airplane so that it points exactly toward a transmitting station of known location. Turn function switch to "COMP," and tune equipment to this station. The indicator pointer should swing to the zero index within 2 degrees.

NOTE

The accuracy of this zero heading will depend upon the following:

- The accuracy with which the fore-and-aft line of airplane was aligned with direction of transmitting station.
- The accuracy with which the loop mounting base was aligned with the fore-and-aft line of the airplane.
- The amount of distortion in the direction of arrival of radio waves caused by unsymmetrical location of loop, in relation to physical make-up of the airplane and accessories. If an error of less than 5 degrees is detected, it can be corrected when radio compass quadrantal error correction is made to the compensator.

4-406. MARKER BEACON SET (RC-193A).

4-407. On Airplanes AF49-2897 through AF49-3596, and AF50-1277 through AF50-1326, the marker beacon set (figure 4-63) consists of a receiver (BC-1033-B), two indicator lights, and an antenna. The receiver, installed on the canopy deck directly behind the SCR-522-A receiver-transmitter, is a three-tube, tuned r-f receiver designed to receive a modulated r-f signal from a marker station and to indicate to the pilot, by means of an indicator light on each instrument panel, when the airplane is over a marker station. The receiver is connected to the 28-volt, d-c bus system through a 5-ampere circuit breaker, on end of right-hand console in front cockpit; therefore, the receiver will be on whenever the bus system is "hot." On Airplanes AF49-2982 and subsequent, the marker beacon indicator light is protected by a 5-ampere circuit breaker on the front right console panel.

4-408. REMOVING MARKER BEACON RECEIVER (BC-1033-B). Remove receiver in the following manner:

a. Remove antenna and power plug from front of receiver panel.

b. Disengage snap slides on receiver mounting plate, and lift receiver off the mount.

4-409. INSTALLING MARKER BEACON RECEIVER (BC-1033-B). Install receiver in the following manner:

a. Place receiver on mounting and secure in place with the four snap slides.

b. Connect antenna and power plugs to receptacles on front of receiver.

c. Check receiver for operation according to paragraph 4-410.

4-410. OPERATIONAL CHECK OF RC-193A MARKER BEACON SYSTEM. Check equipment in the following manner with a test set (I-76).

CAUTION

Do not remove the receiver chassis from the case. Make certain that there are no moving objects in the vicinity of the test oscillator or marker beacon antenna during operational check, as this will cause output meter fluctuations.

a. Insert plug PL-55 from test indicator BE-67 into jack on receiver front panel.

NOTE

The test indicator (BE-67) and test oscillator (BC-376) are a part of the test set (I-76).

b. Apply power to receiver from either an external source, or turn battery switch in airplane to "ON" position.

c. Place toggle switch on test set I-76 to "ADJUST RELAY" position.

d. Adjust the control on test indicator panel to left as far as it will go; then slowly rotate control until indicator lights illuminate. This closing point should fall between 0.40 and 0.44 milliampere on indicator meter.

e. Slowly rotate control counterclockwise (left) until indicator lamps go out, indicating that the relay has opened.

f. Set the test oscillator (BC-376) approximately 10 to 20 feet from the marker beacon receiver antenna located on underside of fuselage, just forward of the tail wheel.

g. Extend the test oscillator antenna to its full length, parallel to the marker beacon antenna.

h. Turn test oscillator (BC-376) to the "ON" position, and set the modulation switch in the 3000-cycle-per-second position.

i. Throw the toggle switch on test indicator panel to the "TUNE RECEIVER" position. Insert plug PL-55 from test indicator BE-67 into the "RELAY" current jack in marker beacon receiver.

j. Using a screwdriver, tune the capacitors, "ANT" and "DET," on marker beacon receiver front panel, for maximum reading on test indicator.

NOTE

Should the meter indicator go off scale, reduce signal strength by collapsing the antenna sections, or by moving test oscillator further from antenna.

k. Make certain receiver is tuned for maximum output. The meter on test set should indicate approximately 1.0 milliampere, when a signal of approximately 1500 microvolts is being received, provided factory sensitivity setting of 1500 microvolts for 1.0 milliampere has not been disturbed.

l. After check is made, remove test set (I-76) and turn off marker beacon receiver.

4-410A. AN/ARN-12 MARKER BEACON.

4-410B. On Airplanes AF51-14314 through AF51-15137, and AF51-17354 and subsequent (figure 4-63C), the marker beacon equipment consists of an R-122/ARN-12 receiver, antenna, and AN3157-4 indicator lights on the instrument panels. When the airplane is over a uhf marker-station, the indicators will illuminate and a tone will be audible in the headset.

4-410C. REMOVING R-122/ARN-12 MARKER BEACON RECEIVER. To remove the marker beacon receiver, proceed as follows:

a. Disconnect electrical plugs from receiver.

b. Disconnect coaxial antenna cable from receiver.

c. Break safety wire and loosen wing nut at front of receiver rack.

d. Lift receiver from rack.

4-410D. INSTALLING R-122/ARN-12 MARKER BEACON RECEIVER. To install the marker beacon receiver, proceed as follows:

a. Position receiver on rack.

b. Tighten wing nut on front of rack, and secure with safety wire.

c. Connect antenna coaxial cable and electrical plugs to receiver.

d. Make operational check.

4-410E. OPERATIONAL CHECK OF R-122/ARN-12 MARKER BEACON RECEIVER. To make an operational check of the marker beacon receiver, proceed as follows:

a. Turn marker beacon receiver on and allow time for proper warm-up.

b. Place BC-376 test oscillator on the ground approximately 15 feet from the marker beacon antenna. Extend test oscillator antenna to its full length, parallel to the fore and aft axis of the airplane.

c. Turn test oscillator on and adjust in accordance with instructions on the cover plate. Set modulation switch to "1300." Observe indicator light for proper operation.

d. Turn interphone system on, and set for "MARKER" signals. Note that audio system is operating properly through interphone volume control.

4-411. INSTRUMENT LANDING SYSTEM (ILS).

4-412. On Airplanes AF49-2897 through AF49-3537, AF50-1277 through AF50-1326, AF51-14314 through AF51-15137, and AF51-17354 and subsequent, wiring, control panels, and mounting provisions only are furnished for the instrument landing system, which is comprised of both the RC-103 and AN/ARN-5 receiving equipment. (See figure 4-63 for location of mounting provisions for various units of equipment.) The wiring provisions at rear cockpit console allow transfer of control of ILS equipment from one cockpit to the other. Modification of the AS-27A/ARN-5 antenna glide path elements must be accomplished before installation, to provide clearance for operation of the landing gear.

4-412A. INSTRUMENT LANDING SYSTEM ANTENNA MODIFICATION. See figure 4-63D.

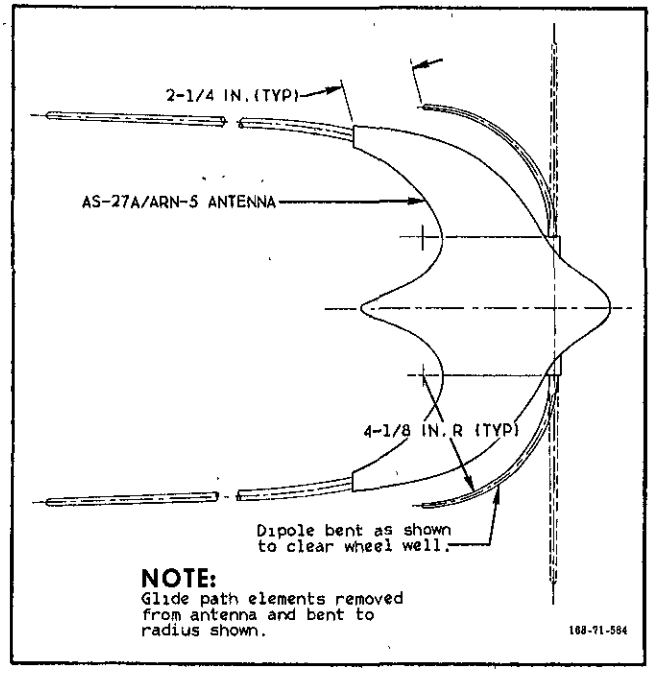


Figure 4-63D. Instrument Landing System Antenna Modification - Airplanes AF49-2897 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent

4-413. INTERPHONE SYSTEM (AIRPLANES AF49-2897 THROUGH AF49-3537 AND AF50-1277 THROUGH AF50-1326).

4-414. On Airplanes AF49-2897 through AF49-3537 and AF50-1277 through AF50-1326, the audio-frequency portion of radio receiver BC-624-A is designed so it is used for interphone communication between the two cockpits. This action is accomplished by a 4pdt relay, in the radio junction box, which is energized by the interphone toggle-type switch, adjacent to the forward throttle quadrant, when held or placed to the momentary or continuous position. Therefore, in order to have interphone communication, the SCR-522-A equipment must be operating. The control box on right-hand console in rear cockpit comprises a potentiometer which controls the amount of audio desired. The relay circuit is protected by a 5-ampere circuit breaker on right-hand console panel in front cockpit.

4-415. OPERATIONAL CHECK OF INTERPHONE SYSTEM (AIRPLANES AF49-2897 THROUGH AF49-3537 AND AF50-1277 THROUGH AF50-1326). Make operational check of interphone system in the following manner:

a. Connect an external source of power to the bus system, or turn on battery-disconnect switch.

b. Turn SCR-522-A equipment on.

c. Close the interphone switch and speak into the microphone. Adjust volume from right-hand console panel in rear cockpit.

4-415A. INTERPHONE SYSTEM (AIRPLANES AF49-3538 THROUGH AF49-3596, AF51-14314 THROUGH AF51-15137, AND AF51-17354 AND SUBSEQUENT).

4-415B. On Airplanes AF49-3538 through AF49-3596, AF51-14314 through AF51-15137, and AF51-17354 and subsequent, the interphone system consists of an AM-300/AIC interphone amplifier, two AM-142/AIC mixer amplifiers, two Type C-695/AIC interphone control panels, two F-21/ARA-9, interphone filters, two interphone switches, and two microphone switches. The AM-300/AIC amplifier, located aft of the engine firewall, amplifies and automatically controls the microphone input power. Automatic control is effected through three barometric-pressure-operated switches. These switches operate to increase microphone input power, in sequence of three, which correspond to altitudes of 10,000, 20,000, and 30,000 feet. The automatic feature compensates for loss of microphone input power experienced at higher altitudes. The AM-142/AIC mixer amplifier, located inside the radio junction box, amplifies all the receiver audio outputs selected for headset operation. The amplifier has no

volume control, having been designed for a fixed maximum value of amplification. The C-695/AIC edge-lighted interphone control panels, located on the right-hand forward and rear consoles, provide the means for switching electronic equipment in or out of the interphone system as required. These control panels are equipped with volume controls to control headset volume.

4-415C. OPERATIONAL CHECK OF INTERPHONE SYSTEM (AIRPLANES AF49-3538 THROUGH AF49-3596, AF51-14314 THROUGH AF51-15137, AND AF51-17354 AND SUBSEQUENT). Make an operational check of the interphone system in the following manner:

a. Connect an external source of power to the bus system, or place battery-disconnect switch in the "BATTERY" position.

b. Check AM-300/AIC on-off switch for safety wired in the "ON" position.

c. Place "INTER," "COMP," "MARKER," and "LOCALIZER" switches (on C-695/AIC panel) in the up or "ON" position.

d. Place range selector switch in "NORMAL USE" position.

e. Place facility selector switch in "MIXED SIGNALS & COMMAND" position.

CAUTION

To prevent radio range course reversal, receiver overloading, or distortion, adjust interphone control panel "VOLUME" control to maximum setting and adjust individual radio set volume controls (one at a time) for proper headset operation.

f. Rotate "VOLUME" control on interphone control panel to maximum output position.

g. Place one radio receiver output on interphone system at a time and adjust individual radio set volume control for proper headset operation.

NOTE

When checking simultaneous voice-range signals, set filter switch (on interphone control panel) to either "RANGE ONLY" or "VOICE ONLY" as required. When listening to ordinary voice signals, place the filter switch in the "NORMAL USE" position.

h. Check special radio (SCR-522-A) operation (from front cockpit) by placing interphone selector switch on "SPECIAL RADIO" position, filter switch on "NORMAL USE," pressing "MIC" button on throttle quadrant, and speaking into microphone. Call local ground station for radio check.

i. Check command set (AN/ARC-3) operation from either cockpit, by placing the interphone selector switch on "MIXED SIGNALS & COMMAND" position, filter switch on "NORMAL USE," pressing "MIC" button on throttle quadrant, and speaking into microphone. Call local ground station for radio check.

j. To communicate between cockpits on interphone operation, momentarily close the interphone switch, located immediately above the throttle quadrant, and speak into microphone. Release interphone switch to receive reply. Only the "INTER" switch on the interphone control panel (C-695/AIC) need be placed in the up or "ON" position to communicate between cockpits. The range switch is placed in the "NORMAL USE" position.

4-416. VACUUM SYSTEM.

4-417. The vacuum system (figure 4-64) consists of an engine-driven pump, oil separator, vacuum relief valve, vacuum control valve, solenoid-operated shut-off valve, vacuum and filter manifold blocks, air filter, suction gage, and tubing that leads to the vacuum-operated instruments on the instrument panels of both cockpits. The vacuum system maintains vacuum for the operation of the directional gyro and gyro horizon, and on Airplanes AF49-2912 and subsequent, the bank-and-turn indicator, in both cockpits. On Airplanes AF49-3538 through AF49-3596, the vacuum system also supplies pressure for the droppable fuel tank by means of a take-off on the overboard side of the air-oil separator. For further information on this function, refer to paragraph 4-329C. All vacuum lines in the system are coded white and green. The operating range for the vacuum system is from 3.75 to 4.25 in. Hg. However, the supply line to the vacuum-operated bank-and-turn indicator incorporates a control valve which reduces the normal working pressure of the vacuum system to 2 in. Hg.

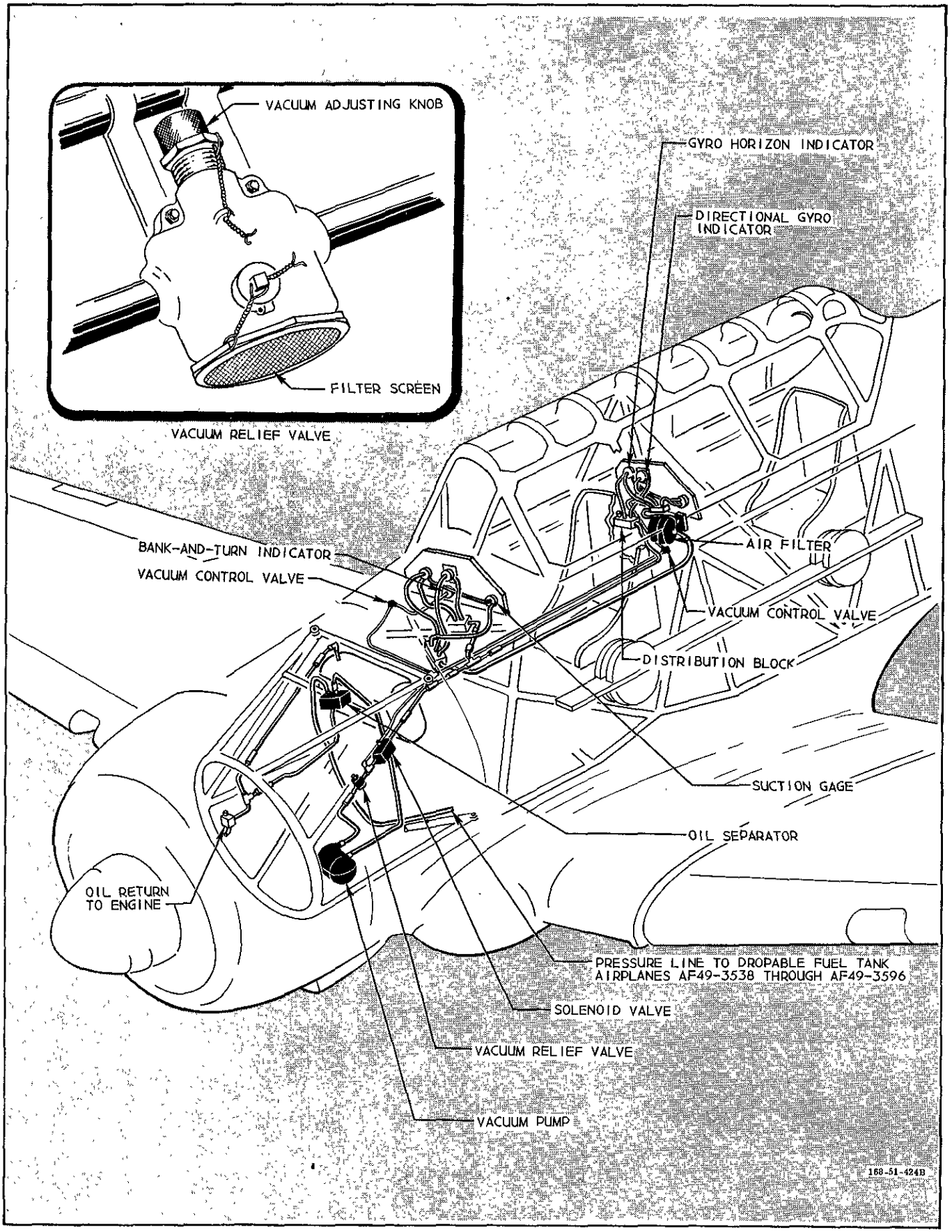


Figure 4-64. Vacuum System

4-418. VACUUM PUMP.

4-419. The engine-driven vacuum pump (Type B-12), mounted on the lower left side in the accessory section of the engine, is of the rotary, four-vane, positive-displacement type. A simple internal oil metering device is incorporated in the pump to allow the proper amount of engine oil to enter the pump through the mounting pad ducts for correct lubrication; the sealed ball bearings packed with grease require no further lubrication.

4-420. REMOVING VACUUM PUMP. To remove vacuum pump, proceed as follows:

a. Remove engine accessory section cowling from left side of airplane.

b. Disconnect suction and discharge lines from vacuum pump.

c. Remove the mounting nuts that secure pump to engine.

d. Slide vacuum pump out and free from the engine.

4-421. INSTALLING VACUUM PUMP. Prior to installation, test the pump for free movement by turning the coupling shaft by hand. To install vacuum pump, proceed as follows:

a. Install a dry gasket (over mounting studs) so that it does not block the oil holes provided for lubrication. Make sure oil holes are clean and free from foreign matter.

b. Wipe pump mounting pad clean, and position pump on engine mounting pad, being careful not to misalign gasket; tighten mounting nuts carefully and evenly.

CAUTION

To ensure proper pump lubrication and to prevent seizure, make sure that oil holes provided in pump pad line up with oil holes on engine drive mounting pad.

c. Connect suction and discharge lines to proper pump ports. The inlet port for either direction of rotation is designated by arrows stamped on exterior machined surface.

d. Replace engine accessory section cowling.

4-422. VACUUM RELIEF VALVE.

4-423. The vacuum relief valve (Type B-12), located on the upper left engine mount tubing, is used to maintain a uniform vacuum in the system through varying engine speeds. The unit is a spring-loaded, disk-type valve, with the disk held against a screened valve seat by a spring, the tension of which may be altered by an adjustment knob on the outside of the housing. The vacuum relief valve regulates the suction in the vacuum lines, and also relieves the pump while the shutoff valve is closed, or if for any reason the inlet lines become clogged or damaged. Always mount valve with screen facing downward or to one side - NEVER UPWARD. Access to the valve is made by removing the left portion of the engine accessory section cowling.

4-424. ADJUSTING VACUUM RELIEF VALVE. Loosen locknut, and turn adjusting knob counterclockwise to increase vacuum and clockwise to decrease vacuum. Adjust the relief valve to provide a vacuum of at least 3.75 in. Hg and not more than 4.25 in. Hg as indicated on the instrument panel suction gage when engine is operating at 1000 rpm (at sea level).

4-425. VACUUM SYSTEM OIL SEPARATOR.

4-426. The oil separator (Type B-12), mounted on the cross frame between the engine mounts, just forward of the oil tank, removes oil from the vacuum pump discharge air. Oil in mist form collects on a baffle screen and drains to the bottom of the separator and through the oil outlet, back to the engine. The oil outlet is a removable fitting that contains a perforated disk strainer. The unit contains no moving parts. Access to the oil separator is gained by removing the top engine accessory section cowling.

4-427. VACUUM SYSTEM AIR FILTER.

4-428. The AN5822-1 air filter (Skinner), located slightly below and forward of the rear cockpit instrument panel, is accessible from the rear cockpit. The filter removes dust and foreign matter from the air entering the vacuum system.

4-429. CLEANING VACUUM SYSTEM AIR FILTER. To clean the air filter, proceed as follows:

a. Remove safety wire from filter bowl mounting bolt.

b. Remove bolt and filter bowl.

c. Slide filter element and diffuser out of the filter bowl.

d. Slide filter element out of diffuser.

e. Apply compressed air to open ends of tubular element and then along elements from either end.

NOTE

Do not apply air at right angles to the elements, as this will have a tendency to wedge impurities between the disks.

f. Wipe foreign matter from the diffuser, and from the inside of the filter head and bowl with a clean, dry, lint-free cloth.

g. Reassemble filter, and safety filter bowl mounting bolt.

4-430. PITOT-STATIC SYSTEM.

4-431. The pitot-static system (figure 4-65) consists of an electrically heated pitot head, two static vents, drain sump, and tubing that leads to flight instruments on the instrument panels of both cockpits. The pitot head is installed on the leading edge of the right wing outer panel. A static vent is located on each side of the rear fuselage, below and aft of the pilot's canopy. The static pressure and pitot pressure lines are connected to the airspeed indicators. The static pressure line is also interconnected to the altimeter and rate-of-climb indicators on each cockpit instrument panel. Pitot-pressure tubing is so installed that moisture will drain into the sump located to the right of the right main gear. Any moisture in the static-pressure tubing will drain out the static vents. All tubing used in the system is identified by colored tape, the pitot-pressure line being coded black, and the static-pressure line, green and black. To facilitate proper connection of lines, the fittings on the rear of the instrument cases are stamped with the letters "S" (static) and "P" (pitot).

4-432. TROUBLE SHOOTING PITOT-STATIC SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Pitot head does not heat or clear itself of ice with "PITOT HEAT" switch turned on.	Circuit-breaker type switch defective.	Replace circuit-breaker type switch.
	Break in wiring.	Repair.
	Heating element in pitot head burned out.	Check for 24 volts at pitot head terminals. If there is voltage at this point, the element is burned out and the pitot head must be replaced.
Pointers indicate incorrectly or oscillate undesirably on altimeter, airspeed indicator, and rate-of-climb indicator.	Leak in case of individual instrument.	Make case leak test for this particular instrument. If it is found defective, replace.
	Leak in pitot or static pressure lines.	Make pitot or static pressure line test. Repair.
	Pitot or static pressure lines obstructed because of accumulation of foreign matter.	Disconnect instruments, and clean lines.

4-433. TESTING STATIC-PRESSURE LINES.

a. Install masking tape over the static-pressure vent on each side of the fuselage.

b. Remove static-pressure hose from the airspeed indicator on the rear cockpit instrument panel, and attach a source of suction to the static-pressure hose.

c. Set altimeter pointer to "0."

d. Slowly apply suction (within the range of the rate-of-climb indicator) until altimeter reads 10,000 feet; then "pinch off" tube and secure it with a suitable clamp.

e. The altimeter must not indicate less than 7000 feet after one minute. Tap the altimeter to keep the pointer swinging freely.

f. If the altimeter reads less than 7000 feet, a line leak is indicated. To locate the leak, slowly remove source of suction within the range of the rate-of-climb indicator and disconnect the static line fittings from the altimeter, rate-of-climb, and airspeed indicators. Plug five of the six open ends, and attach a source of pressure to the remaining hose assembly. Apply pressure and use a soap and water solution to locate the leak. Tighten or repair faulty connection or replace damaged tubing.

CAUTION

Never apply pressure to static lines with the instruments connected.

g. Remove pressure source and plugs, and reconnect static-pressure lines to the indicators. Remove masking tape from static-pressure vents.

4-434. TESTING PITOT-PRESSURE LINE.

a. Connect a source of pressure to opening of the pitot head.

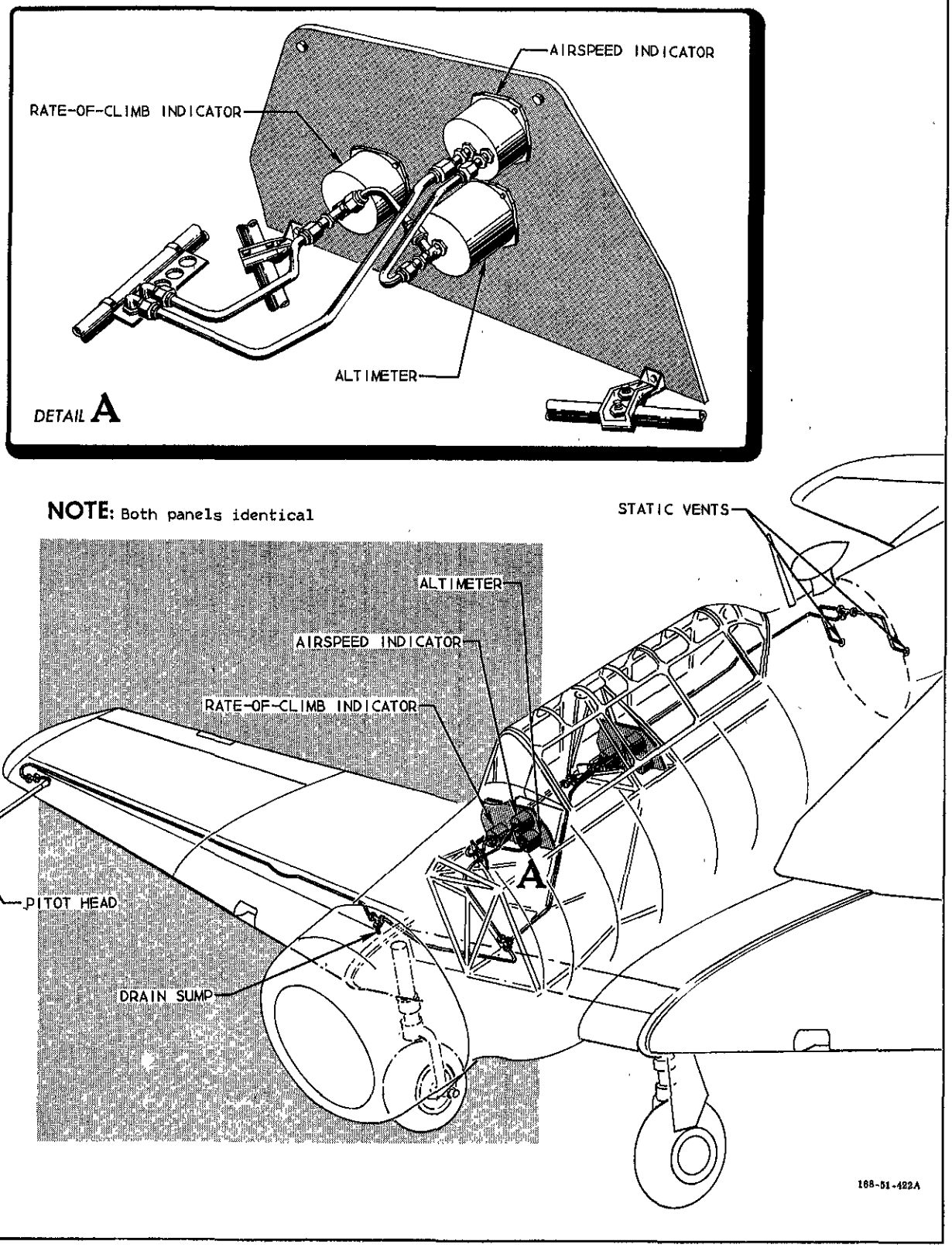


Figure 4-65. Pitot-Static System

b. Apply pressure slowly until airspeed indicator reads 150 mph; then "pinch off" source of pressure, and secure with a suitable clamp.

c. The airspeed indicator must not show less then 144 mph after one minute. Tap the indicator to keep the pointer swinging freely.

d. If the airspeed indicator reads less than 144 mph, locate leak with soap and water solution; then repair connection or replace tubing.

e. After test is completed, remove source of pressure from pitot head.

CAUTION

Do not apply suction to pitot-pressure line.

4-435. PITOT HEAD.

4-436. The pitot head (AN5816-2), a single unit installed so that its axis is parallel to the longitudinal axis, or thrust line, of the airplane, furnishes an accurate value of impact (pitot) pressure, caused by the motion of the airplane through the surrounding air. The forward end of the pitot head is open so that it may be subjected to the full force of the impact pressure. The pitot head assembly is equipped with a resistance-type heater in the forward end. This heater prevents the formation of ice in the opening, and consequent erroneous indications of airspeed. A circuit-breaker type switch marked "PITOT HEATER" is located on the right-hand console of the front cockpit.

CAUTION

To prevent burning out of heater element, turn "PITOT HEATER" switch to "OFF" position when airplane is on the ground.

4-437. REMOVING PITOT HEAD. To remove the pitot head, proceed as follows:

a. Remove the four screws that hold pitot head to support assembly.

b. Carefully slide pitot head forward sufficiently to expose the coupling on the pressure line.

c. Disconnect electrical plug.

d. Hold the forward coupling rigid, to prevent shearing the pressure line from pitot head, and rotate aft nut to release coupling and free pitot head.

4-438. INSTALLING PITOT HEAD. To install the pitot head, proceed as follows:

a. Connect pressure lines together by turning aft coupling nut and holding forward nut rigid.

CAUTION

Hold forward coupling nut rigid to avoid damaging forward pitot pressure line. (The tubing will shear if line is allowed to turn.)

b. Connect electrical plug.

c. Slide pitot head back into support assembly.

d. Install four screws securing pitot head to support assembly.

4-439. INSTRUMENT SYSTEM.

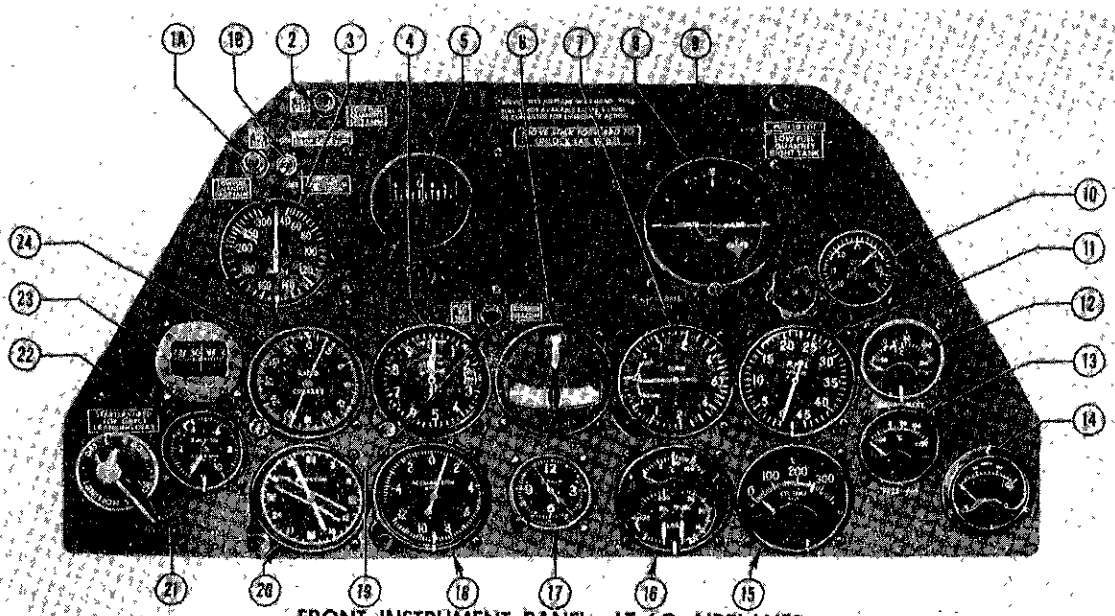
4-440. Identical instruments are mounted on the forward and aft instrument panels. Front and rear instrument panels are identical on all T-6G Airplanes. On all LT-6G Airplanes, the airspeed indicator and the directional gyro have been moved to the left on the front instrument panel to make room for the gun sight (figure 4-66). The instrument complement is broken down into three groups: flight, engine, and miscellaneous. Each group of flight instruments includes an airspeed indicator, a directional gyro, a gyro horizon, a rate-of-climb indicator, a turn-and-bank indicator, an altimeter, and a standby and a remote compass. The engine instruments consist of a manifold pressure indicator, a carburetor mixture temperature indicator, a tachometer, an engine gage, and cylinder head temperature indicators. The miscellaneous instruments include a free air temperature indicator, a d-c ammeter, a suction gage, an accelerometer, and a clock. All instruments are of the rear-mounted type.

4-441. TROUBLE SHOOTING INSTRUMENTS.

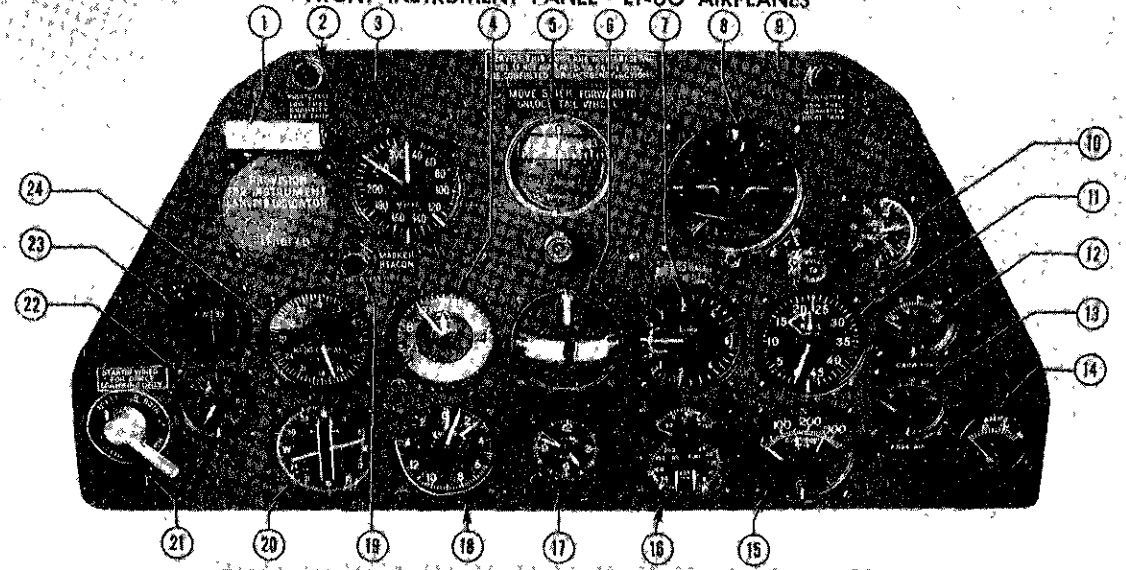
TROUBLE	PROBABLE CAUSE	REMEDY
	ALTIMETER	
Instrument fails to operate.	Static pressure lines are blocked.	Disconnect all instruments operating on static pressure lines. Blow lines clear with clean, dry air. Reconnect lines.
Incorrect indication.	Slow leak in diaphragm.	Replace instrument.

TROUBLE	PROBABLE CAUSE	REMEDY
Pointer oscillates.	Irregular static pressures received in instrument case.	Check static lines for restriction.
	Leak in instrument case.	Seal case.
FREE AIR TEMPERATURE INDICATORS		
No reading.	Open circuit in resistance bulb.	Replace bulb.
	Broken wiring or poor connection in receptacle.	Check continuity of wiring and receptacle connections.
Pointer goes off high end of scale.	Broken grounded lead.	Repair or replace lead.
	Improper connection.	Connect wires correctly.
STAND-BY COMPASS AN5766-2		
Discolored liquid.	Deterioration.	Replace the unit.
Compass is erratic, or does not respond to compensation.	Magnets demagnetized, or compensating gear magnets demagnetized.	Replace the compass.
TACHOMETER		
Excessive scale error.	Weak magnets in the tachometer generator.	Replace tachometer generator.
Pointer moves backward.	Reversed polarity.	Change leads at terminals of tachometer generator.
RATE-OF-CLIMB INDICATOR		
Pointer fails to respond.	Obstruction in static line.	Disconnect all instruments connected to airspeed static line. Open drain and blow lines clean.
Pointer indicates inaccurately.	Leak in static line.	Check by static leak test. Correct leak or replace instrument.
	Leak in instrument case.	Test for case leak. Replace.
Pointer oscillates.	Leak in static line.	Use static leak test. Seal any leaks found.
OIL TEMPERATURE INDICATOR		
Pointer fails to register.	Break in power leads.	Repair broken wiring.
Jerky pointer movement.	Pointer touching dial or glass.	Straighten pointer.
Pointer flutters.	Broken lead wire making intermittent contact.	Locate break, and repair.
Indicator reads too high on the scale.	Connections from voltage supply are in error, causing a high voltage at instrument.	Check connections to make sure 24-volt line is connected to the "A" terminal on the plug.
FUEL AND OIL PRESSURE GAGES		
Pointer fails to register.	Pressure line plugged.	Remove obstruction.
Pointer fails to return to "O."	Foreign matter in pressure line.	Remove obstruction.
Pointer fails to register full pressure.	Leak in pressure line.	Repair or replace the line.

TROUBLE	PROBABLE CAUSE	REMEDY
	GYRO HORIZON INDICATOR	
Horizon bar fails to respond.	Instrument caged.	Uncage.
	Insufficient vacuum resulting from the following:	
	Suction regulator improperly adjusted.	Adjust properly.
	Incorrect indicator reading.	Calibrate.
	Pump failure.	Replace pump.
Horizon bar does not settle.	Insufficient vacuum.	Correct as outlined in preceding "Probable Cause."
	Defective mechanism.	Replace instrument.
Horizon bar oscillates or vibrates excessively.	Instrument caged.	Uncage the instrument.
	Excessive vacuum, resulting from the following:	
	Air filter dirty.	Clean or replace filter.
	Suction regulator improperly adjusted.	Adjust suction regulator.
	Defective mechanism.	Replace instrument.
	REMOTE-INDICATING COMPASS	
	NOTE The following data is applicable when the airplane is pointed on a North heading. Letters used refer to wires corresponding to plug terminal pin markings anywhere in the circuit.	
No torque.	"A" shorted to "B."	Correct wiring.
	Inverter not operating.	Replace inverter if necessary.
Reverse rotation.	"A" and "B" reversed with "C" and "D" reversed.	Correct wiring.
Erratic operation in the 90-degree arc between 300 degrees and 30 degrees.	Lead to "D" open.	Repair or replace lead.
Erratic operation in the 90-degree arc between 330 degrees and 60 degrees.	Lead to "C" open.	Repair or replace lead.
Pointer pulls in at both 30 degrees and 210 degrees; that is, at either of these headings, the pointer is pulled away in one direction or the opposite.	"A" wire open (power reaching one unit).	Repair wiring.
	"D" shorted to "A" or "B."	Repair wiring.
	"A" - "D" phase open in either transmitter or indicator coils.	Replace instrument.
	"A" and "D" reversed.	Correct wiring.
Compensator does not have sufficient effect.	Weak compensation magnets in transmitter.	Remove transmitter, and repair.



FRONT INSTRUMENT PANEL – LT-6G AIRPLANES



TYPICAL FRONT AND REAR INSTRUMENT PANEL – T-6G AIRPLANES

1 COURSE REMINDER*
1A DROP TANK LOW-FUEL-QUANTITY INDICATOR LIGHT
1B DROP TANK FUEL SELECTOR SWITCH
2 LEFT TANK LOW-FUEL-QUANTITY INDICATOR LIGHT
3 AIRSPEED INDICATOR
4 ALTIMETER
5 DIRECTIONAL GYRO
6 TURN-AND-BANK INDICATOR
7 RATE-OF-CLIMB INDICATOR
8 GYRO HORIZON INDICATOR
9 RIGHT TANK LOW-FUEL-QUANTITY INDICATOR LIGHT
10 MANIFOLD PRESSURE GAGE
11 TACHOMETER
12 CARBURETOR MIXTURE TEMPERATURE INDICATOR
13 FREE AIR TEMPERATURE INDICATOR
14 AMMETER
15 CYLINDER HEAD TEMPERATURE INDICATOR
16 ENGINE GAGE UNIT – FUEL AND OIL PRESSURE AND OIL TEMPERATURE
17 CLOCK
18 ACCELEROMETER
19 MARKER BEACON INDICATOR LIGHT
20 REMOTE-INDICATING COMPASS INDICATOR
21 IGNITION SWITCH
22 SUCTION GAGE
23 STAND-BY COMPASS
24 RADIO COMPASS INDICATOR

*COURSE REMINDER IS NOT PROVIDED ON LT-6G AIRPLANES AND T-6G AIRPLANES AF51-14314 THROUGH AF51-15137, AND AF51-17354 AND SUBSEQUENT.

168-51-830C

Figure 4-66. Instrument Panel

4-442. FLIGHT INSTRUMENTS.

4-443. ALTIMETER (AN5760 SERIES). The altimeter indicates the height of the airplane above the barometric pressure level setting of the barometric scale, visible through the window in the altimeter dial. This barometric scale, calibrated in inches of mercury, is set manually by a knob on the lower left-hand corner of the case. The altimeter has a range of 0 to 50,000 feet. There are three pointers on the altimeter dial: the large pointer indicates altitude in units of 100 feet and completes one revolution for each 1000-foot change in altitude; the second pointer indicates altitude in units of 1000 feet and completes one revolution at every 10,000-foot change in altitude; the third pointer indicates altitude in units of 10,000 feet. The altimeter is connected to the static vents by means of the static pressure lines described in paragraph 4-431.

4-444. AIRSPEED INDICATOR (TYPE C-14). The Type C-14 airspeed indicator is essentially a conventional airspeed indicator calibrated from 40 to 300 miles per hour. The instrument, one installed on each instrument panel, is connected to the pitot-static system (figure 4-65), the connections being identified by "P" and "S" for pitot and static pressure.

4-445. TURN-AND-BANK INDICATOR (AN5819 SERIES). The turn-and-bank indicator is provided to indicate the lateral attitude of the airplane in straight flight, and to provide a reference for the proper execution of a coordinated turn-and-bank. The indicator is vacuum-operated and receives its motive power from the vacuum system of the airplane. The bank indicator is a liquid-filled curved tube in which a free-rolling inclinometer ball changes position according to the direction of the force of gravity and centrifugal force.

4-446. RATE-OF-CLIMB INDICATOR (AN5825 SERIES). The rate-of-climb indicator shows the rate of ascent or descent of the airplane; it is used in making banked turns without gain or loss of altitude, and in establishing a definite and constant rate of descent in making an instrument landing. The instrument operates on static pressure taken from static ports as shown in figure 4-65.

4-447. DIRECTIONAL GYRO (AN5735 SERIES). The directional gyro is used to supplement the magnetic compass in maintaining the airplane on a straight course. Relative movement of the airplane to the right or left shows on a circular card which is graduated in degrees, the same as the compass card. The gyro operates in vacuum derived from the engine-driven vacuum pump, the principal unit in the vacuum system.

4-448. GYRO HORIZON (AN5736 SERIES). The gyro horizon indicator is used during instrument flights to indicate the relative longitudinal and lateral attitude of the airplane. The instrument is supplied with a caging knob and connects to the vacuum system. (See figure 4-64.)

4-449. STAND-BY COMPASS. The stand-by compass on the instrument panel, used in case of an emergency, consists of a metal bowl filled with compass fluid, and a semi-float type card graduated in 5-degree increments. For the purpose of correcting card deviations resulting from magnetic disturbances, a permanent magnet compensator is attached to the compass. This type compass should be compensated every 100 hours, or at least once in each 3-month period, and at times when a change of equipment likely to affect the instrument is made. A Type B-16 stand-by compass is installed on Airplanes AF51-14314 through AF51-15137, and AF51-17354 and subsequent. All other airplanes use Type AN5766-2 stand-by compass.

4-450. REMOTE-INDICATING COMPASS SYSTEM. This system consists of two compass indicators (AN5730 Series), one transmitter, and an inverter. The indicators are mounted one on each instrument panel, and the transmitter is installed in the tail section of the airplane aft of baggage compartment. The system is powered by the single-phase, 400-cycle, 6 volt-ampere, 26-volt a-c inverter mounted on left rear side of rear cockpit. The transmission of magnetic indications of the transmitter to the indicators is entirely electrical, the only rotating parts in the system being the compass float and the indicator rotors. The system uses a self-synchronous method of electrically transmitting induced voltages from the coil in the transmitter to the coil in the indicator. The coils are wired in parallel and are energized by the alternating current. A permanent magnet mounted on a shaft is free to rotate in the center of the transmitter coil magnetic field. Rotation of the permanent magnet, by adjustment, will cause the indicators to follow in the same direction and with the same angular displacement. Each indicator shaft carries the pointer which shows the magnetic heading of the airplane.

4-451. COMPASS SWINGING.

4-452. The compass swinging procedure for either the stand-by or the remote-indicating compass is essentially the same, except that the remote-indicating compass requires that the electrical system of the airplane be turned on. Compensation, if required, is accomplished by setting of compensating magnets. They are within the case of the stand-by compass, whereas compensating magnets of the remote-indicating compass are located in the transmitter. The swinging procedure consists of positioning airplane to actual magnetic headings, and comparing with compass readings. Differences are recorded on AF Form No. 57 (figure 4-67) and are algebraically calculated to provide compensating values so that ultimate compass correction values entered on the form are at a minimum. Either of two methods, the sighting compass method or the compass rose method, may be employed for determining actual magnetic headings.

4-453. COMPASS SWINGING PROCEDURE. It is not necessary to level the airplane to swing the compass, as leveling provisions have been included for the compass transmitter. To swing the compass, proceed as follows:

a. Select a flat area to park the airplane for swinging the compass, or position the airplane on a compass rose.

	Compensating Swing			Residual Swing		Aircraft Comp		Date: 6-13-49
	Actual Head (M)	Aircraft Comp	Dev'n	Actual Head (M)	Aircraft Comp	C to M		M to C
N 000	000	004	-4	000	000	0	000	0
NE 045				045	045	0	045	0
E 090	090	088	+2	090	090	0	090	0
SE 135				135	135	0	135	0
S 180	180	178	+2	180	179	+1	180	-1
SW 225				225	225	0	225	0
W 270	270	274	-4	270	270	0	270	0
NW 315				315	316	-1	315	+1
	(1)	(2)	(1)-(2)	(3)	(4)	(3)-(4)		(4)-(3)

If swinging compass used ahead of aircraft add or subtract 180 degrees.

Coeff. C = $\frac{N-S}{2} = \frac{(+4)-(+2)}{2} = \frac{-6}{2} = -3$

Coeff. B = $\frac{E-W}{2} = \frac{(+2)-(-4)}{2} = \frac{+6}{2} = +3$

Coeff. A = $\frac{N+E+S+W}{4} = \frac{(+4)+(+2)+(+2)+(-4)}{4} = \frac{-4}{4} = -1$

16-99556-1 149-51-247

Figure 4-67. Sample AF Form No. 57

CAUTION

The airplane must be at least 100 yards from automobiles, tractors, steel buildings, or other aircraft. All magnetic materials such as pocket knives, tools, mechanical pencils, watches, and steel scales must be removed from personnel engaged in swinging the compass. All airplane equipment having any magnetic effect on the compass must be secured in the position occupied during normal flight.

b. Level compass transmitter by removing screws from aft end of transmitter bracket, and installing a wood spacer. Transmitter should be set within 5 degrees of level position while compass is being compensated.

NOTE

After compass has been compensated, make sure wood spacer is removed and transmitter bracket screws are reinstalled.

c. The direct-reading compass must be filled with compass fluid. If the external surface of the direct-reading compass is damp with liquid, or a bubble forms within the compass, this is an indication that liquid is required and the compass must be filled.

d. Align the white dots on the compensating screws with the dots on the direct-reading compass, using a nonmagnetic screwdriver; the compensating screws are behind the small plate on the front of the instrument. On the remote-indicating compass, the compass access door on top of the fuselage must be removed in order to align the white dots. Turn on the inverter that supplies power to the remote-indicating compass by turning on the battery switch, or by attaching an external power supply to the airplane.

e. Head the airplane to Magnetic North, East, South, and West, using either method (swinging base or sighting compass), and read the airplane compass.

NOTE

Start engine; if there is no deviation in reading between engine running and engine stopped, the remainder of the compass swinging can be done while the engine is not running.

f. Enter the magnetic headings and compass readings in their appropriate spaces under "Compensating Swing" on AF Form No. 57. (See sample form, figure 4-67.) Subtract the airplane compass readings from the corresponding magnetic headings to obtain the deviations. Enter the deviations and their signs in the next column.

g. Using the recorded deviations, calculate the Coefficients A, B, and C, according to the formulas on the lower part of the form. (Refer to paragraph 4-454.)

h. With the airplane on Magnetic North, add Coefficient C algebraically to the airplane compass reading on that heading to determine what the instrument should indicate when compensated. Make the compass indicate the compensated value by adjusting the N-S compensating screw (use nonmagnetic screwdriver).

i. With the head of the airplane on Magnetic East, add Coefficient B algebraically to the airplane compass reading on that heading to determine what the instrument should indicate when compensated. Make the compass indicate the compensated value by adjusting the E-W compensating screw (use nonmagnetic screwdriver).

NOTE

If the N-S compensating screw is inadvertently moved when the airplane is heading Magnetic East, procedure h. must be repeated. Before doing so, reset the N-S compensating screw for zero effect.

j. This step will be necessary only with the remote-indicating compass. With the airplane on any heading, add Coefficient A algebraically to the reading of the compass on that heading to determine what the instrument should read when compensated. Make the compass indicate the compensated value by rotating transmitter bodily clockwise if Coefficient A is positive, or counterclockwise if Coefficient A is negative. Then secure the compass.

k. Place the head of the airplane on the cardinal and quadrantal magnetic headings, and enter the magnetic headings and the corresponding compass readings in their proper spaces on AF Form No. 57 under "Residual Swing."

l. Fill out Column "C to M" by subtracting Column 4 "Aircraft Comp" from Column 3 "Actual Head (M)," and Column "M to C" by subtracting Column 3 from Column 4. Then fill in blanks on back of

card. Tear off the compass card and place in the compass card holder in the cockpit. File remainder of card as a permanent record.

4-454. CALCULATING COEFFICIENTS. Calculate Coefficients A, B, and C, on bottom of AF Form 57 (figure 4-67) as follows:

a. Coefficient A - To add deviations having the same sign, all (+) or all (-), merely add the deviations and use the same sign. To add deviations having different signs, some (+) and some (-), add the deviations having the same signs, and subtract the smaller total from the larger total; then use the sign of the larger total. Example: $(-4) + (+2) + (+2) + (-4) = (-8) - (+4) = -4$.

b. Coefficients B and C - To subtract deviations having the same or different signs, change the sign of the deviation to be subtracted, and then add as explained in procedure a.

Example: "B" $(+2) - (-4) = (+2) + (+4) = +6$
"C" $(-4) - (+2) = (-4) + (-2) = -6$

NOTE

Examples are calculated using assumed deviations from figure 4-67.

4-455. ALGEBRAIC TEST OF COMPASS COMPENSATION. Proper compensation of the compass can be checked algebraically by making up new Coefficients C, B, and A, using deviations shown in either Column "C to M" or "M to C"; the result must not be more than 1. In this example:

$$C = \frac{N - S}{2} = \frac{(0) - (+1)}{2} = -\frac{1}{2} = -1/2$$

$$B = \frac{E - W}{2} = \frac{(0) - (0)}{2} = \frac{0}{2} = 0$$

$$A = \frac{(0) + (0) + (+1) + (0)}{4} = \frac{+1}{4} = +1/4$$

4- 456. ENGINE INSTRUMENTS.

4-457. MANIFOLD PRESSURE INDICATOR (AW-1-7/8-32-AF4). An aneroid-type manifold pressure indicator is installed on each instrument panel. The indicator is calibrated from -10 to +40 inches of mercury. A valve, on the forward left side of forward cockpit, is connected between instruments and the engine take-off. This valve, when opened during engine run-up at idling speed, allows any moisture in line due to condensation to be sucked out by the engine. During all other times, the valve must be in the closed position.

4-458. CARBURETOR MIXTURE TEMPERATURE INDICATOR (AN5790-6). Each carburetor mixture temperature indicator, an electrical-resistance type thermometer commonly known as a ratiometer, is a temperature-measuring instrument that is designed to operate in conjunction with a resistance bulb above the carburetor and in the air intake manifold. Each instrument, calibrated from -50°C to 150°C (-58°F to 302°F), is connected electrically to its respective resistance bulb. Power for these instruments is taken from the 28-volt d-c system.

4-459. ENGINE GAGE (AN5773 SERIES). Each engine gage is comprised of three instruments within one case: oil temperature, oil pressure, and fuel pressure. The oil temperature portion of the engine gage operates on a ratiometer principle with a resistance bulb installed in the oil "Y" drain valve. Power for this ratiometer instrument is taken from the 28-volt d-c system. The circuit is protected by a 5-ampere circuit breaker. The remaining two instruments are conventional pressure-type instruments.

4-460. CYLINDER HEAD TEMPERATURE INDICATOR (TYPE B-9). Each cylinder head temperature indicator is calibrated from 0°C to 300°C (32°F to 572°F), and is connected to a one-ohm thermocouple system. The two instruments are connected in parallel and connect through thermocouple leads to No. 5 engine cylinder.

4-461. TACHOMETER (AN5530 SERIES). Each tachometer indicator indicates speed of rotation of engine. The two instruments, calibrated from 0 to 45 rpm x 100, are connected in parallel across the output of one tachometer generator mounted on engine pad. This generator produces a three-phase alternating current when mechanically operated by the engine. The alternating current is transmitted to the indicator rotors, which revolve at a rate directly proportional to the engine speed.

4-462. MISCELLANEOUS INSTRUMENTS.

4-463. ACCELEROMETER (AN5745 SERIES). The accelerometer furnishes an indication of the load on the structure of the airplane in turns of gravitational ("G") units and in increments of the gross weight of the airplane. The instrument consists of one main pointer and two auxiliary pointers arranged concentrically to show acceleration on a common scale. The main pointer indicates instantaneous acceleration, and moves either clockwise or counterclockwise. The two auxiliary pointers, until reset, will remain at the maximum positive or negative readings, for any particular maneuver. The middle pointer records positive acceleration, while the one nearest the dial records negative acceleration. The unit is self-contained and requires no external connections.

4-464. FREE AIR TEMPERATURE INDICATOR (AN5790-6). Each free air temperature indicator, used to indicate outside temperature, is a ratiometer-type instrument. Each unit is an electrical temperature-measuring instrument that is designed to operate in conjunction with an external resistance, in the carburetor air intake duct, acting as a sensing unit. The system depends on the 28-volt d-c electrical system of the airplane for its power.

4-465. SUCTION GAGE (AN5771-5). A vacuum system suction gage, mounted on each instrument panel,

indicates the amount of pressure below atmospheric pressure to the gyro instruments. The faces of the instruments are graduated from 0 to 10 inches of mercury. Two inches of mercury is approximately equivalent to one pound per square inch. The instruments and the system in which they operate are covered in paragraph 4-417.

4-466. CLOCK (AN5743-1). Each clock is a standard 8-day aircraft clock with a sweep second hand.

4-467. INSTRUMENT LANDING SYSTEM INDICATOR (I-101-D). Provisions for the installation of the ILS indicator in each instrument panel are included only on T-6G Airplanes AF49-2897 through AF49-3537, AF50-1277 through AF50-1326, AF51-15138 through AF51-15237, and AF51-16071 through AF51-16083.

4-468. FUSELAGE EQUIPMENT.

4-469. SEATS.

4-470. Two seats are installed, one in the forward and one in the rear cockpit. Each seat is equipped with a Type B-14 safety belt and Type B-15 shoulder harness. The safety belt is installed in the conventional manner. The seats allow a vertical adjustment that is controlled by a lever on the right side. Each seat has a back cushion.

4-470A. SHOULDER HARNESS INERTIA REEL. A two-position (locked and unlocked) shoulder harness inertia reel lock control is located on the left side of the seat. A latch is provided for positively retaining the control handle at either position of the quadrant. When top of control handle is pressed down, the latch is released and the control handle may then be moved freely from one position to another. When the control is in the locked position, the reel harness cable is manually locked so that the pilot is prevented from bending forward. When the control is in the unlocked position, the reel harness cable will extend to allow the pilot to lean forward in the cockpit; however, the reel harness cable will automatically lock when an impact force of 2 to 3G is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to the locked position and then returned to the unlocked position.

4-471. REARVIEW MIRROR.

4-472. A rearview mirror is attached to the right-hand side of the windshield bow in the front cockpit.

4-473. RELIEF TUBES.

4-474. There is a relief tube stowed in a bracket under the front cockpit seat and one in a bracket on the left side of the rear cockpit.

4-475. FIRST-AID KIT.

4-476. A first-aid kit is installed on the bulkhead on the right side of the rear cockpit, aft of the seat.

4-477. FLIGHT REPORT HOLDER.

4-478. A flight report holder is located on the left side of the forward cockpit, aft of the seat.

4-479. FIRE EXTINGUISHER.

4-480. A Type A-2 fire extinguisher is located on the inside of a door on the left side of the aft cockpit. It is accessible from inside or outside of the airplane.

4-481. MAP CASE.

4-482. A map case is provided in the front cockpit, below the right console.

4-482A. DATA CASE.

4-482B. A data case is provided in the compartment just aft of the loop antenna.

4-483. INSTRUMENT FLYING HOOD.

4-484. A quickly detachable hood is installed in the rear cockpit. For instrument training, the hood opens forward, covering the rear cockpit, and is attached to the instrument panel shield by a spring-loaded latch. Elastic cord attached to the hood will return the hood to the stowed position when the latch is released. The seat must be lowered to provide head clearance when the hood is used.

4-485. ENGINE STARTER HANDCRANK.

4-486. An engine starter handcrank is stowed in the baggage compartment.

4-487. HEATING AND VENTILATING SYSTEM.

4-488. Hot and cold air ventilating system controls are provided between the rudder pedals in the front cockpit. (See figure 4-68.) Hot or cold air is regulated into the cockpits as required by operating a notched control wheel fitted with a butterfly valve at the outlet of each system. Cold air is taken through a screened inlet, located in the leading edge of the wing center section at the left of the fuselage, and passes through flexible tubes and fittings that are attached to the inside structure of the wing center section, to the cold air butterfly valve in the front cockpit. The heating system consists of a two-section steel heater which completely envelopes the exhaust pipe of No. 1 and 9 cylinders, two insulated flexible tubes, a fitting that connects the tubes at the firewall, and the hot air butterfly valve. The air is heated by the exhaust manifold. At the left end of the heater unit is a connection and an air passage vent between the top and bottom section of the heater unit. A pipe, with an opening between the No. 1 and 2 cylinders, admits air to the right end of the lower heater unit section. The air passes over baffles in the lower section, through the opening to the top section of the heater unit, over baffles in the top section, and through the flexible tube to the hot air butterfly valves located in the cockpit at the right of the cold air butterfly valve. A ventilator door is located at the left rear side of the rear cockpit, and the amount of airflow is governed by moving a control handle to the desired position between the full open and full closed position. In addition to the ventilator controls, further ventilation may be obtained by opening the sliding sections of the cockpit enclosure to any one of the intermediate positions.

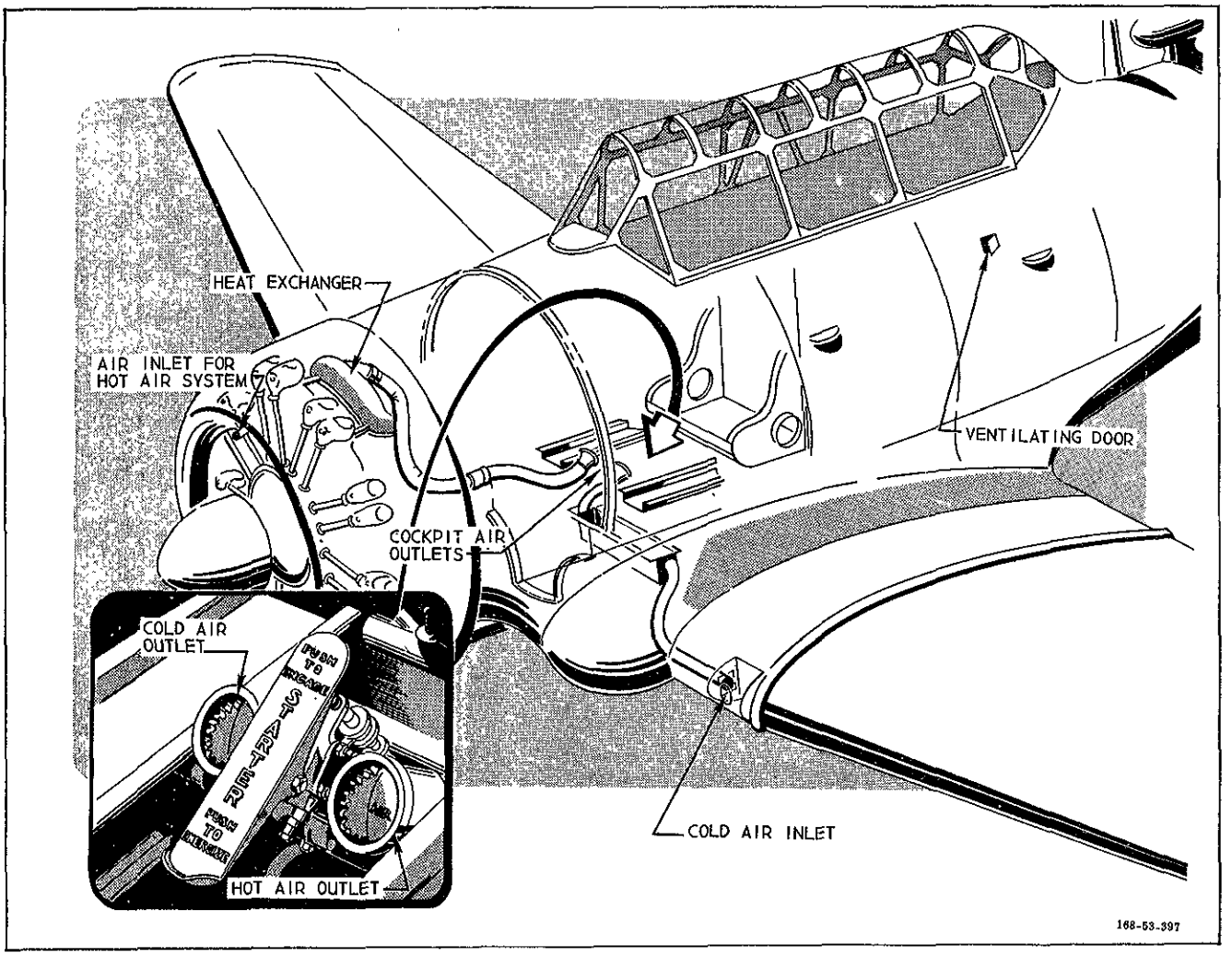


Figure 4-68. Heating and Ventilating System

4-489. TROUBLE SHOOTING HEATING AND VENTILATING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Airflow not available from hot air control valve.	Air inlet between No. 1 and 2 cylinders obstructed.	Remove obstruction.
	Break in ducting between air inlet and hot air outlet.	Locate break and repair.
Airflow not available from cold air control valve.	Air inlet in wing leading edge obstructed.	Remove obstruction.
	Break in ducting between air inlet and cold air outlet.	Locate break and repair.

4-490. BOMBING SYSTEM.

4-491. On Airplanes AF49-3538 through AF49-3596, three S-2 bomb racks can be installed on the underside of each wing. (See figure 4-70.) The maximum load for each bomb rack is 100 pounds. An adapter launcher for three 2.25-inch SCA rockets can be carried on each of the two outboard bomb racks. A manual electrical release and arming system is provided. (See figure 4-69.) There is no mechanical release. A modified N-3C optical sight with an A-2 head is provided for bomb aiming. (Refer to paragraph 4-533.) Selection of the type of release is accomplished by setting the armament master selector switch to "SINGLE BOMB," "BOMB SALVO," or "JETTISON." The bomb and rocket button switch will release a

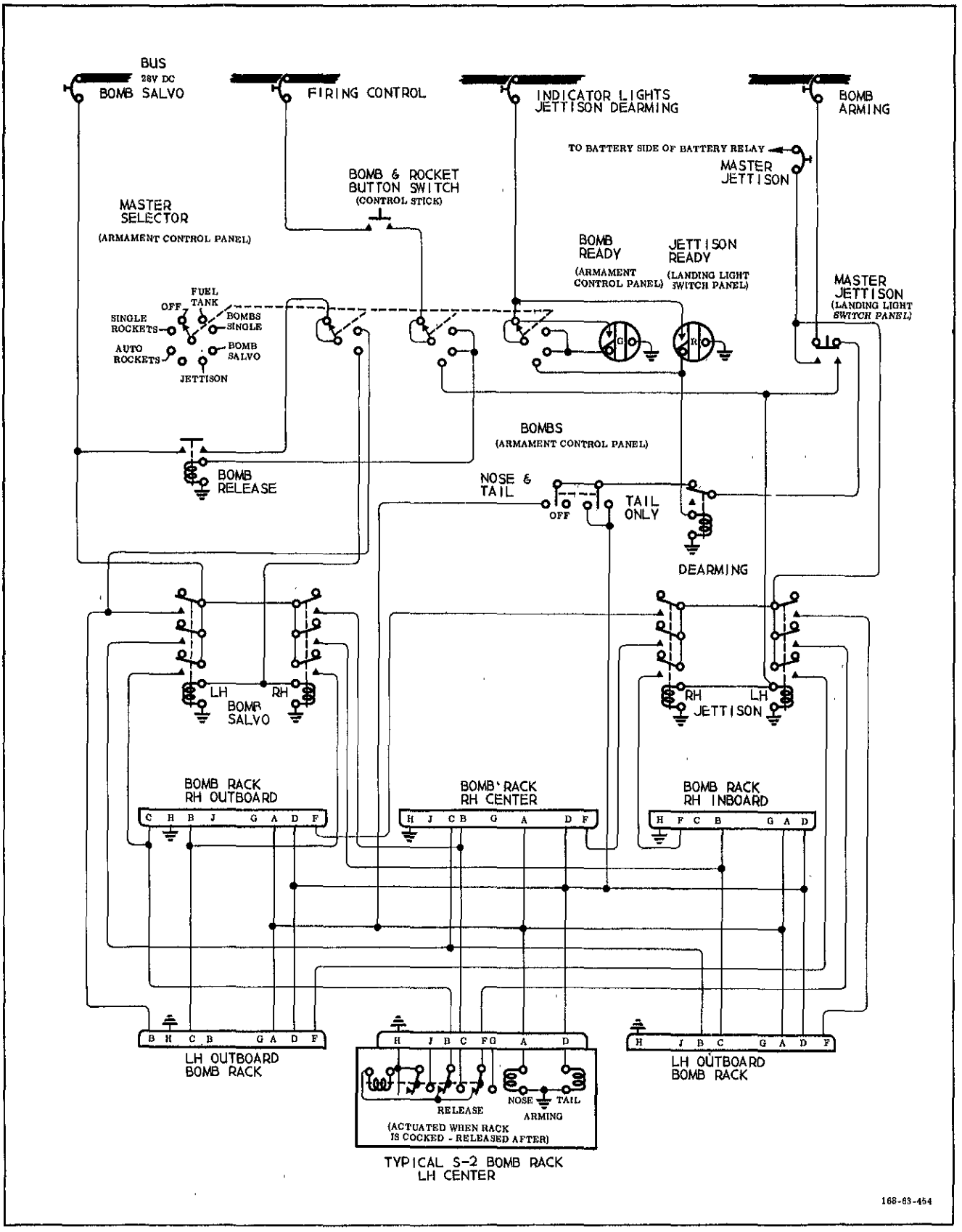


Figure 4-69. Bombing System Schematic

bomb each time it is pressed when the armament master selector switch is at "SINGLE BOMB." A single impulse from the bomb-rocket switch will release all bombs if selection is "BOMB SALVO." "JETTISON" release is the same as "BOMB SALVO" except that bombs will be dropped unarmed. A master jettison button switch will release the bombs unarmed.

The bomb arming switch provides selection of "NOSE & TAIL" or "TAIL ONLY" arming in "SINGLE BOMB" or "BOMB SALVO" release only. A bomb-ready indicator light will light in either the "SINGLE BOMB" or "BOMB SALVO" release. A jettison-ready indicator light illuminates in the "JETTISON" release. (See figures 4-69 and 4-70.)

4-492. TROUBLE SHOOTING BOMBING SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Bomb racks do not release in "BOMB SALVO."	No power on circuit. Defective armament master selector switch or bomb and rocket button switch. Defective bomb release or bomb salvo relays. Defective bomb racks.	
Improper release or no release in "SINGLE BOMB."	Defective armament master selector switch or bomb and rocket button switch. Defective transfer circuit in bomb rack(s). Improper or faulty wiring. Defective bomb release relay.	
Bombs do not arm in "SINGLE BOMB" or "BOMB SALVO."	Defective arming switch. Defective master jettison switch. Defective arming relay. Defective bomb rack.	
Bombs drop armed in "JETTISON" or "MASTER JETTISON."	Defective arming or master jettison switches. Defective arming relay. Defective jettison relays. Defective bomb racks.	
Indicator lights fail to light.	Defective bulb. Defective bulb socket.	

4-493. TESTING BOMBING SYSTEM.

4-494. Before loading bomb racks, and using an external power source, accomplish the following steps to test bomb system. (See figures 4-69 and 4-70.)

a. Cock bomb racks by pulling cocking ring.

b. Turn armament master selector switch to "SINGLE BOMB." The green bomb indicator should light.

c. Place an arming wire swivel in each arming unit. Arming wire should be held firmly.

d. Press bomb and rocket button switch. The left-hand outboard bomb rack should release and both nose and tail arming wires should drop.

e. Repeat impulses from the bomb and rocket button switch until all bomb racks release. The sequence of release from left-hand outboard should be: right-hand outboard, left-hand center, right-hand center, left-hand inboard, and right-hand inboard bomb racks. All arming wires should drop.

f. Place arming switch to "NOSE & TAIL"; then repeat steps a. through e. All bomb racks should release and all arming wires should be retained in arming unit as long as arming solenoid is energized.

g. Place arming switch to "TAIL ONLY"; then repeat steps a. through e. All tail arming wires should be retained, and all nose arming wires should drop.

h. Turn armament master selector switch to "BOMB SALVO" and repeat steps b., c., d., f., and g. All bomb racks should release on first impulse. Arming wires should be retained or released the same as for "SINGLE BOMB."

i. Turn armament master selector switch to "JETTISON" and repeat steps b., c., d., f., and g. All bomb racks should release with first impulse. Arming wire should be dropped in all positions of the arming switch. The red jettison-ready indicator should light.

j. Disconnect external power and be sure battery switch is "OFF." Cock all bomb racks and place arming wires in all arming units. Place arming switch to "NOSE & TAIL." Press master jettison switch. All arming wires should drop.

4-495. BOMB RACKS.

4-496. Each bomb rack (Type S-2) consists of a front and rear support assembly, release and arming assembly, bomb sway braces, electrical control wiring, and a streamlined fairing. Each bomb rack will support any size bomb up to 100 pounds. The bomb fuse arming wire is held by a slide that grips the arming wire firmly when the bomb rack is cocked. If bombs are released in an unarmed condition, the slide that holds the arming wire releases the arming wire at the same time the bombs drop. If bombs are released in an armed condition, an arming solenoid will retain the arming wire. The bomb rack fairing has two holes; one provides access to a manual tripping lever, and the other permits inspection of the bomb rack lock.

4-497. REMOVING BOMB RACKS. Remove the four bomb rack mounting bolts. Lower bomb rack to

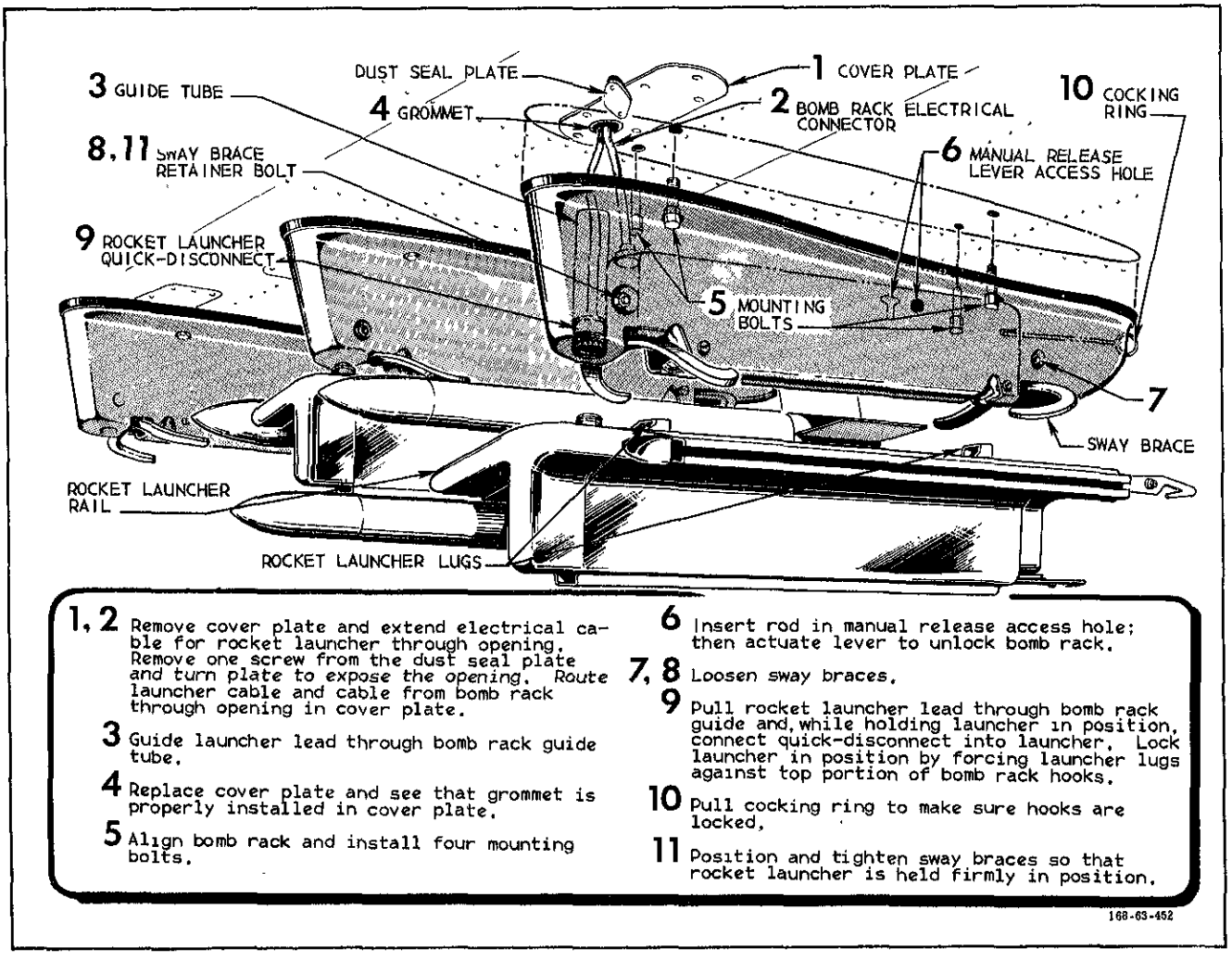


Figure 4-70. Installing Bomb Rack and 2.25-inch Rocket Launcher Adapter

allow removal of electrical wiring access cover plate; then disconnect bomb rack wiring in wing. Replace electrical wiring access cover plate so that wiring outlet cutout is covered. (See figure 4-70.)

4-498. INSTALLING BOMB RACKS. See figure 4-70.

4-499. ROCKET SYSTEM.

4-500. On Airplanes AF49-3538 through AF49-3596, two 5-inch HVAR rockets may be carried outboard of the gun package on each wing outer panel or three 2.25-inch SCA rockets may be carried on each of the two outboard bomb racks. (See figures 4-70 and 4-72.) The rockets are aimed through a modified N-3C optical sight utilizing an A-2 head. (Refer to paragraph 4-533.) A Type A-3 release control is incorporated in the electrical release system. An AN-N6 GSAP camera, for recording rocket scoring, is located in the left wing. There are two methods of rocket release; "SINGLE ROCKETS" and "AUTO ROCKETS." The 2.25-inch SCA rockets may be jettisoned in the same manner as the bombs. (Refer to paragraph 4-491.) The 5-inch HVAR rockets cannot be jettisoned or released in an unarmed condition. With the master selector switch turned to "SINGLE ROCKETS," one rocket will be fired each time the bomb and rocket button switch is pressed. With switch at "AUTO ROCKETS," the rockets will be fired in train as long as the bomb and rocket button switch is held in a depressed position. Arming for the 5-inch HVAR rockets is controlled by an arming switch for either delayed or instant arming. There is no arming control for the 2.25-inch SCA rockets.

4-501. TROUBLE SHOOTING ROCKET SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
Rockets do not fire with master selector switch in "SINGLE ROCKETS."	No power on circuit.	
	Defective bomb and rocket button switch or master selector switch.	
	Projector release control reset knob not set.	
	Snap switch in release control not closing contact.	Tighten mounting screws; position adjusting screw or bend spring assembly until contacts close properly.
	Release control snap spring broken.	
	Release control resistor burned out.	
	Release control coils not energized.	Check power source.
	Release control finger contacts not making contact.	Replace finger contact assembly.
	Pawl out of adjustment.	
Rockets-ready indicator fails to light.	Defective master selector switch.	
	Burned-out bulb or defective socket.	
Rocket station dial will not reset to desired number.	Loose dial.	Remove panel assembly.
	Ratchet assembly loose on shaft.	Position and tighten setscrew.
	Pawl not releasing ratchet.	Adjust armature stop, pawl front stop, and pawl back stop for proper spacing.
	Pawl spring broken.	
Improper sequence of rocket firing.	Defective wiring.	
	Release control defective.	

TROUBLE	PROBABLE CAUSE	REMEDY
	Release control not properly set, thereby firing wrong rocket first. Defective rocket selector switch.	
Rocket camera fails to operate.	Defective master selector switch. Camera defective.	
Five-inch HVAR rockets fail to arm properly.	Defective arming switch, master selector switch, or master jettison switch. Defective arming relay. Defective arming solenoid.	

4-502. TESTING ROCKET SYSTEM (5-INCH ROCKETS).

4-503. With an external power source connected to the airplane, accomplish the following with rocket launchers installed.

a. Connect the four rocket-firing leads to a circuit tester.

b. Place the armament master selector switch at "SINGLE ROCKETS." The green rocket-ready indicator should light.

c. Set the release control knob to "1."

d. Press the bomb and rocket button switch four times. With each impulse from the button switch, the circuit tester lights should flash in the following order: left-hand outboard, right-hand outboard, left-hand inboard, and right-hand inboard.

e. Reset release control knob to "1." Place armament master selector at "AUTO ROCKETS." Press and hold bomb and rocket button switch. The circuit tester lights should flash at 1/10-second intervals in the same sequence as in step d.

f. Place arming wires in all arming units. Position rocket arming switch to "DELAY." A pull of 3 pounds should hold the arming wires, and a pull of 4 pounds should release arming wire.

g. Place arming wires in arming units. Position rocket arming switch to "INSTANT." All arming wires should be held firmly.

4-504. TESTING ROCKET SYSTEM (2.25-INCH ROCKETS).

4-505. With an external power source connected to the airplane, accomplish the following with 2.25-inch rocket launchers installed.

a. Connect a circuit tester to the 12 rocket-firing leads. (See figure 5-4.)

b. Place armament master selector switch at "SINGLE ROCKETS." The green rocket-ready indicator should light.

c. Set release control knob to "1."

d. Press the bomb and rocket button switch 12 times. With each impulse from the button switch, the circuit test lights should flash as shown in figure 5-4.

e. Reset release control knob to "1." Place armament master selector switch at "AUTO ROCKETS." Press and hold bomb and rocket switch. The circuit test lights should flash at 1/10-second intervals in the same sequence as in step d.

4-506. 5-INCH ROCKET LAUNCHERS.

4-507. Each rocket launcher assembly consists of a front and a rear mount. (See figure 4-72.) The front mount is slotted to receive the front rocket button lug. An AN-A-2 arming unit is housed in the front mount. The rear mount consists of a supporting latch for the rear rocket tunnel lug, an igniter receptacle, and a knife for cutting the igniter wire.

4-508. REMOVING 5-INCH ROCKET LAUNCHERS. Remove mounting screws from the front and rear launcher mounts, and disconnect the electrical wiring. (See figure 4-72.)

4-509. INSTALLING 5-INCH ROCKET LAUNCHERS. See figure 4-72.

4-510. 2.25-INCH ROCKET LAUNCHERS.

4-511. Rocket launcher assemblies are of one basic design, there being no right or left parts identified as such. Each launcher assembly consists of launching rails, latches, and knife assemblies. These units are supported by a common structure and are served electrically from a centrally located connector. Two mounting lugs on each launcher assembly are inserted into the bomb rack hooks and are retained in the same way in which a bomb is normally held. Bomb rack sway braces bear on sway brace pads on the launcher assembly, thereby stabilizing the launcher. Electrical connections for each rocket launcher

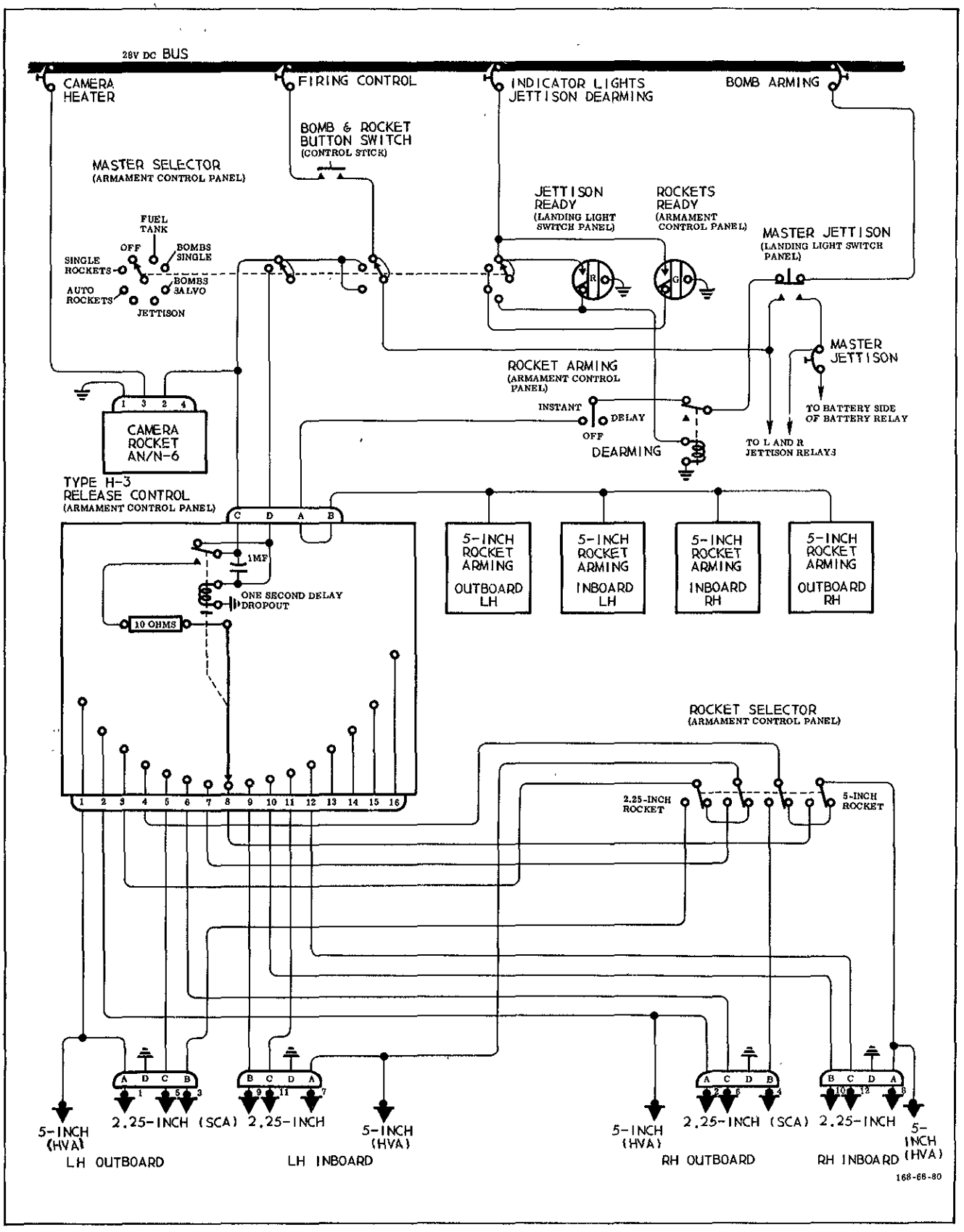


Figure 4-71. Rocket System Schematic

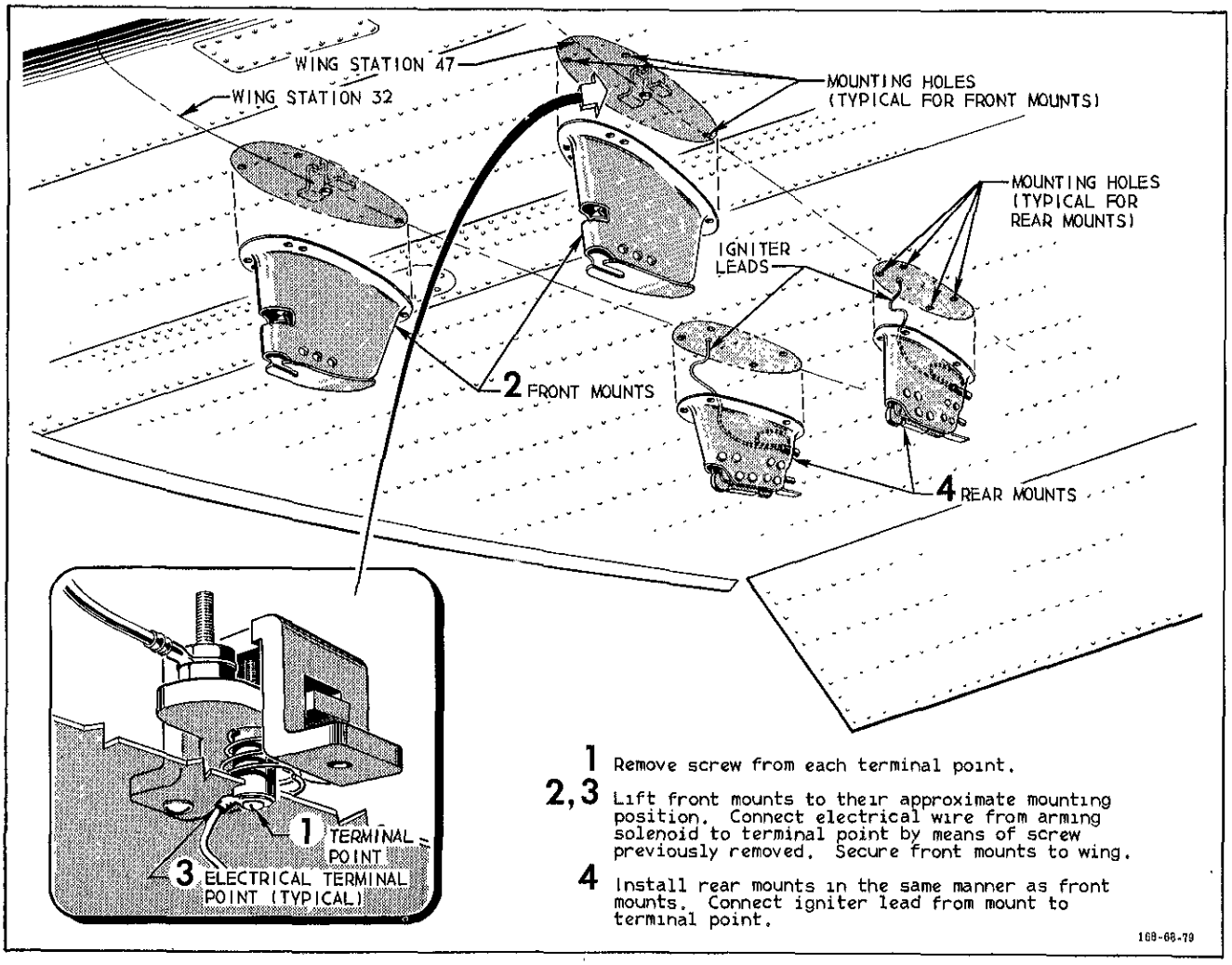


Figure 4-72. Installing 5-inch Rocket Launchers

assembly are secured by a clip installed inside the wing.

4-512. REMOVING 2.25-INCH ROCKET LAUNCHERS. To remove the rocket launcher, proceed as follows:

a. Insert a rod through the manual trip hole on the left side of the bomb rack and actuate trip lever.

b. Lower the rocket launcher until the electrical quick-disconnect pulls apart.

c. Lower the bomb rack (paragraph 4-497); then remove armament electrical cover plate and secure the electrical plug by means of clip inside of wing.

d. Replace armament electrical cover plate so that electrical lead outlet hole is covered.

4-513. INSTALLING 2.25-INCH ROCKET LAUNCHERS. See figure 4-70.

4-514. ROCKET RELEASE CONTROL.

4-515. The Type A-3 rocket release control is an electric-mechanical intervalometer having a hand reset knob and a visual numbered dial. In automatic operation, the control sends out impulses at 1/10-second intervals, starting with the rocket number corresponding to the dial setting. With each impulse the dial number increases one and the electrical circuit is transferred to the next rocket to be fired. Automatic operation starts when the master selector switch is in "AUTO ROCKETS" and the bomb and rocket button switch is depressed. Operation continues as long as the button switch is held in a depressed position. In single operation, the bomb and rocket button switch must be actuated for each rocket fired. To obtain proper firing sequence, the dial must be set to start at "1."

4-516. ROCKET CAMERA.

4-517. A Type AN-N6 camera with a built-in overrun control is installed on an adjustable mount in the leading edge of the left wing. The camera mount provides azimuth and elevation adjustment and a lockscrew to set the adjustment. In order to prevent damage to the camera mechanism in the event of a

film jam, a spring clutch is incorporated between the camera mount and the change gear train assembly. A motor cutout is also in the circuit to cut off the power in the event of a jam or unusually heavy load. Automatic operation of the camera during gun firing or rocket firing is provided.

4-518. REMOVING ROCKET CAMERA. To remove camera without disturbing the elevation and azimuth adjustments, first make sure camera operates properly; then proceed as follows:

a. Open camera access door.

b. Disconnect electrical connector from camera.

c. Cut safety wire from camera retaining screw.

d. Loosen locknut from camera retaining screw.

e. Hold camera firmly, and loosen sight retaining screw; then remove camera. (See figure 4-76.)

4-519. INSTALLING ROCKET CAMERA. See figure 4-76.

4-520. HARMONIZING ROCKETS AND ROCKET CAMERA.

4-521. Rockets require no harmonizing; for camera sighting, see figure 4-76.

4-522. GUNNERY SYSTEM.

4-523. On Airplanes AF49-3538 through AF49-3596, a streamlined gun package can be installed on the underside of each wing outer panel. The guns are ground-charged. An N-3C gun sight with an A-2 bombsight head is mounted on the instrument panel shroud of the pilot's compartment. A Type AN-N6 gun camera is mounted in the leading edge of the left wing and is harmonized for gun scoring. The guns, sight, and camera are controlled from the pilot's compartment through an electrical control system. (See figures 4-73 and 4-74.) With the gun switch in "GUNS - SIGHT & CAMERA" position, pressing the gun trigger switch to the first position will set the camera in operation. The second position of the trigger switch will fire the guns. With the gun switch in "SIGHT & CAMERA" position, only the camera will operate through the trigger switch. Brightness of the reticle image in the gun sight is controlled by a rheostat. Refer to paragraph 4-533 for control of the adjustable head and reflector.

4-524. TROUBLE SHOOTING GUNNERY SYSTEM.

TROUBLE	PROBABLE CAUSE	REMEDY
	GUNS	
Guns fail to fire.	Guns not loaded, charged, or head-spaced.	
	Defective guns.	
	Defective ammunition or links.	
	No power supply.	
	Gun selector switch on "GUNS - SIGHT & CAMERA."	
	Defective gun trigger switch.	Replace grip.
	Defective gun selector switch.	
	Defective gun-firing relay.	
	Defective gun solenoid.	
Ammunition fails to feed.	Ammunition container overloaded.	
	Feed chute not properly installed.	
	Defective guns.	
	Defective ammunition.	
Guns fail to hit target.	Gun and gun sight not harmonized.	
	Gun mounts loose.	
	Gun barrel worn or warped.	

TROUBLE	PROBABLE CAUSE	REMEDY
	GUN CAMERA	
Motor fails to operate.	Gun selector switch not on. Defective gun trigger switch. Defective motor. Motor brushes worn.	Replace camera.
Motor runs but camera fails to operate.	Speed setting knob in neutral position.	Set knob to desired speed.
Gear train stops; clutch on motor slips.	Magazine jams, causing motor cutout to open the circuit.	Remove magazine and allow motor to cool; then replace magazine.
Magazine jams.	Magazine driving spline not engaged.	Replace magazine. Make certain magazine is inserted all the way into camera.
	Improper operation of film claw.	Using a gun camera "GO NO-GO" gage, align the guide rail at top of aperture plate so that film claw travels back and forth smoothly on an even plane.
	Improper operation of magazine driving spline.	Make sure left washer, attached to driving spline, is properly engaged between the clutch retracting arm and the driving shaft retaining spring.
Film image blurred (film moves, shutter open).	Improper operation of film claw.	Using a "GO NO-GO" gage, align guide rail so that film claw travels smoothly back and forth on an even plane.
	Improper timing of shutter and film claw.	Time shutter with film claw.
Negative out of focus.	Lens assembly securing nuts loose. Dirty filter.	
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4-525. TESTING GUNNERY SYSTEM.

4-526. Before loading guns, turn battery switch "ON" and accomplish the following steps to test the gunnery system.

a. Position gun selector switch to "GUNS - SIGHT & CAMERA."

b. Depress gun trigger switch to the first position. Gun camera should operate.

c. Depress gun trigger switch to the second position. Camera should continue to run, and gun-firing solenoid should operate.

d. Turn rheostat control knob to the right. The

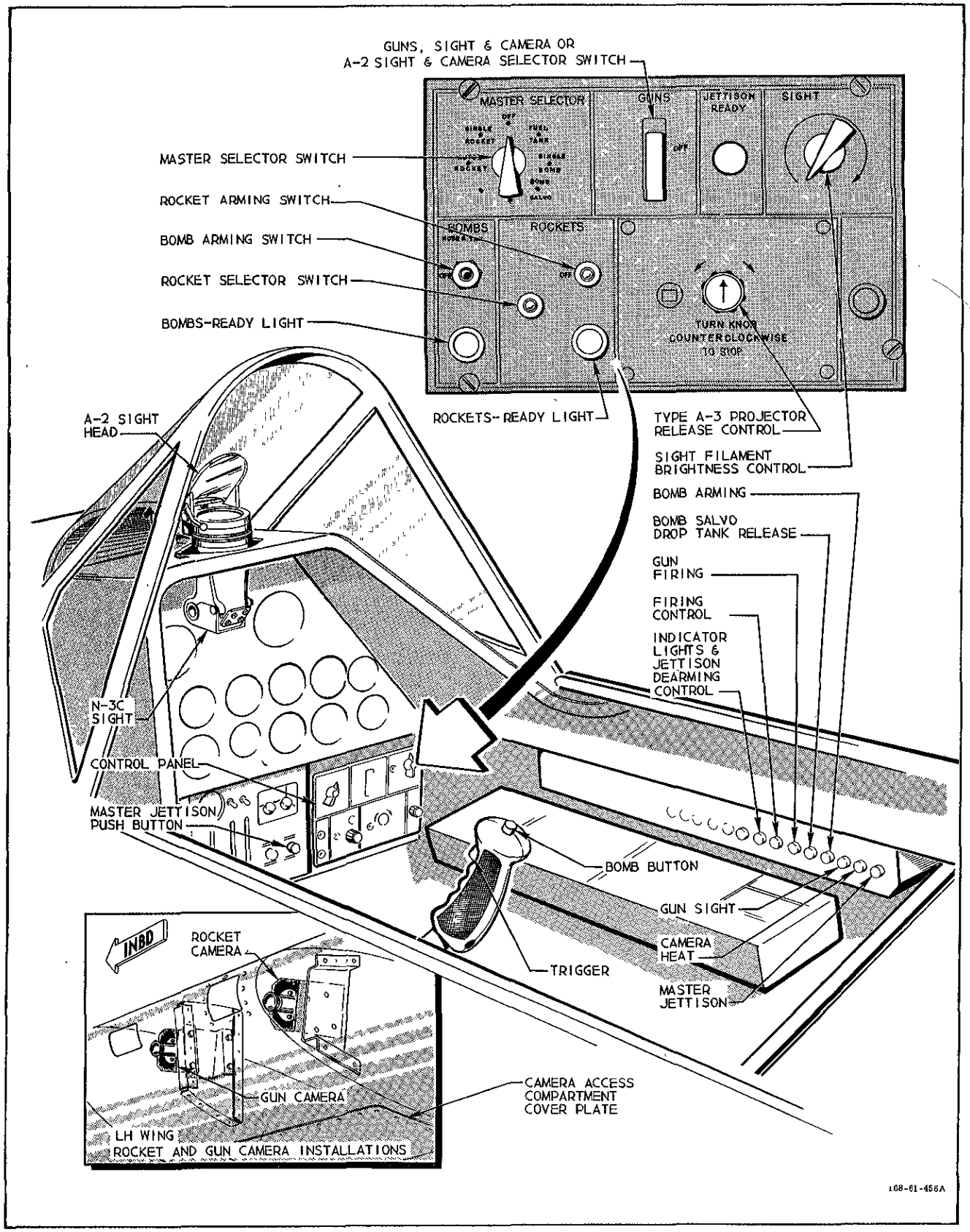

Figure 4-73. Gunnery System

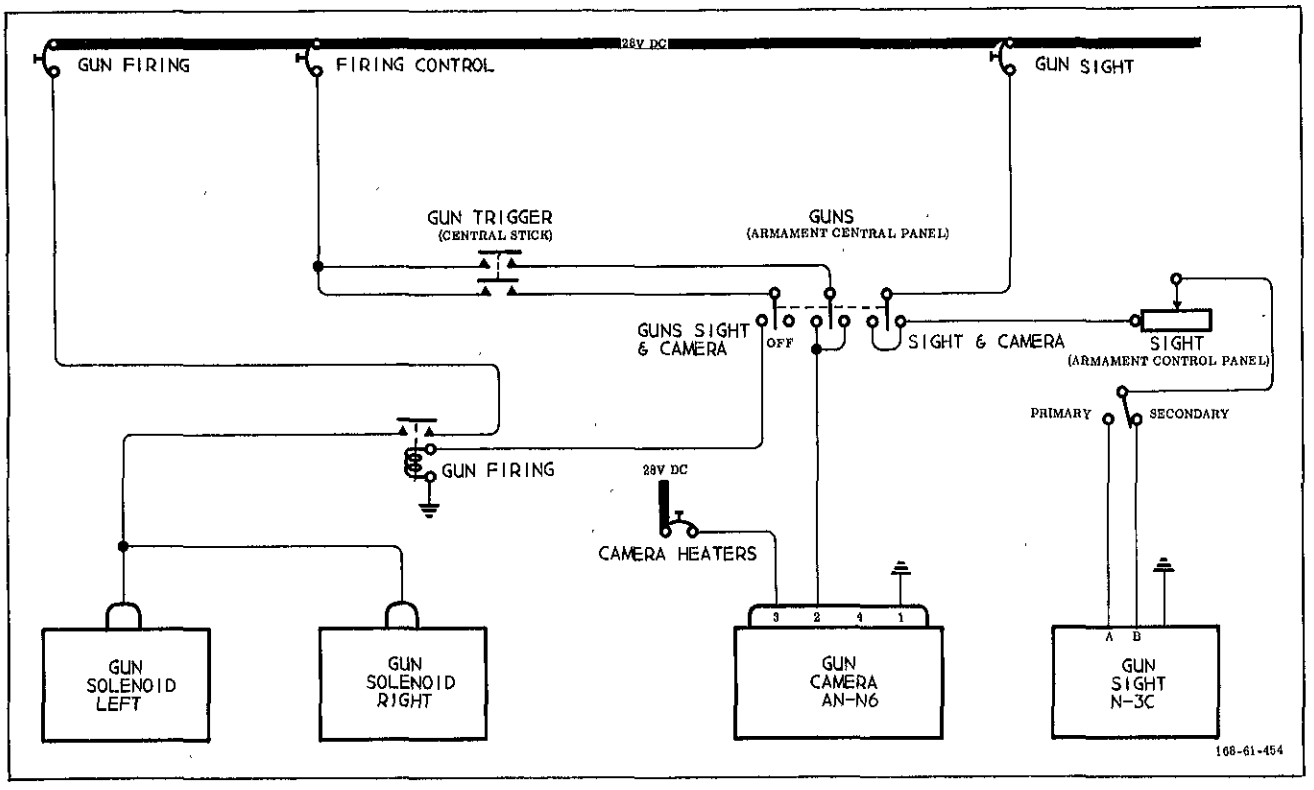

Figure 4-74. Gunnery System Schematic

reticle image should appear on the reflector. The rheostat should control the brightness of the reticle image.

e. Position gun selector switch to "SIGHT & CAMERA." Repeat steps b. through d. The gun solenoid should not operate. The sight and camera should function the same as in steps b. through e.

4-527. GUN PACKAGE.

4-528. Each gun package is equipped with a Type M-2 .30-caliber machine gun; a combined ammunition container for 250 rounds and compartments for expended links and cases; a feed chute; and a gun-firing solenoid. A stowage bag is incorporated in the gun package fairing to hold a manual gun charger and cover plates.

4-529. REMOVING GUN AND GUN PACKAGE. To remove the gun and gun package, see figure 4-75 and proceed as follows:

a. Remove gun package fairing.

b. Open gun cover and disengage any remaining ammunition.

c. Remove pins securing feed chute to the gun and ammunition container. Then remove feed chute.

d. Remove ammunition container.

e. Disconnect wiring from gun-firing solenoid.

f. Loosen rear gun mount clamp by pulling out and turning adjustment knob.

g. Pull front gun mount pin; then pull gun sidewise and aft.

h. Remove grommet on gun solenoid electrical lead.

i. Remove the four gun package mounting bolts; then slowly lower gun package and pull solenoid wiring through support channel.

j. Remove cover plate and stow wire inside of wing.

4-530. INSTALLING GUNS AND GUN PACKAGE. See figure 4-75.

4-531. HARMONIZING GUNS, SIGHT, AND CAMERA. Figure 4-76 contains all the necessary information for harmonizing guns, sight, and cameras. The bore-sighting configuration shown is for maximum velocity condition.

4-532. GUN, BOMB, AND ROCKET SIGHT.

4-533. A Type N-3C optical sight with an A-2 adjustable head and reflector glass may be used for gun, bomb, and rocket aiming. The sight is clamped in a support assembly that mounts on the instrument panel shroud in the pilot's compartment. A hole through the shroud permits the A-2 head and reflector glass to extend above the shroud. The N-3C sight body extends below the shroud. (See figure 4-73.) The

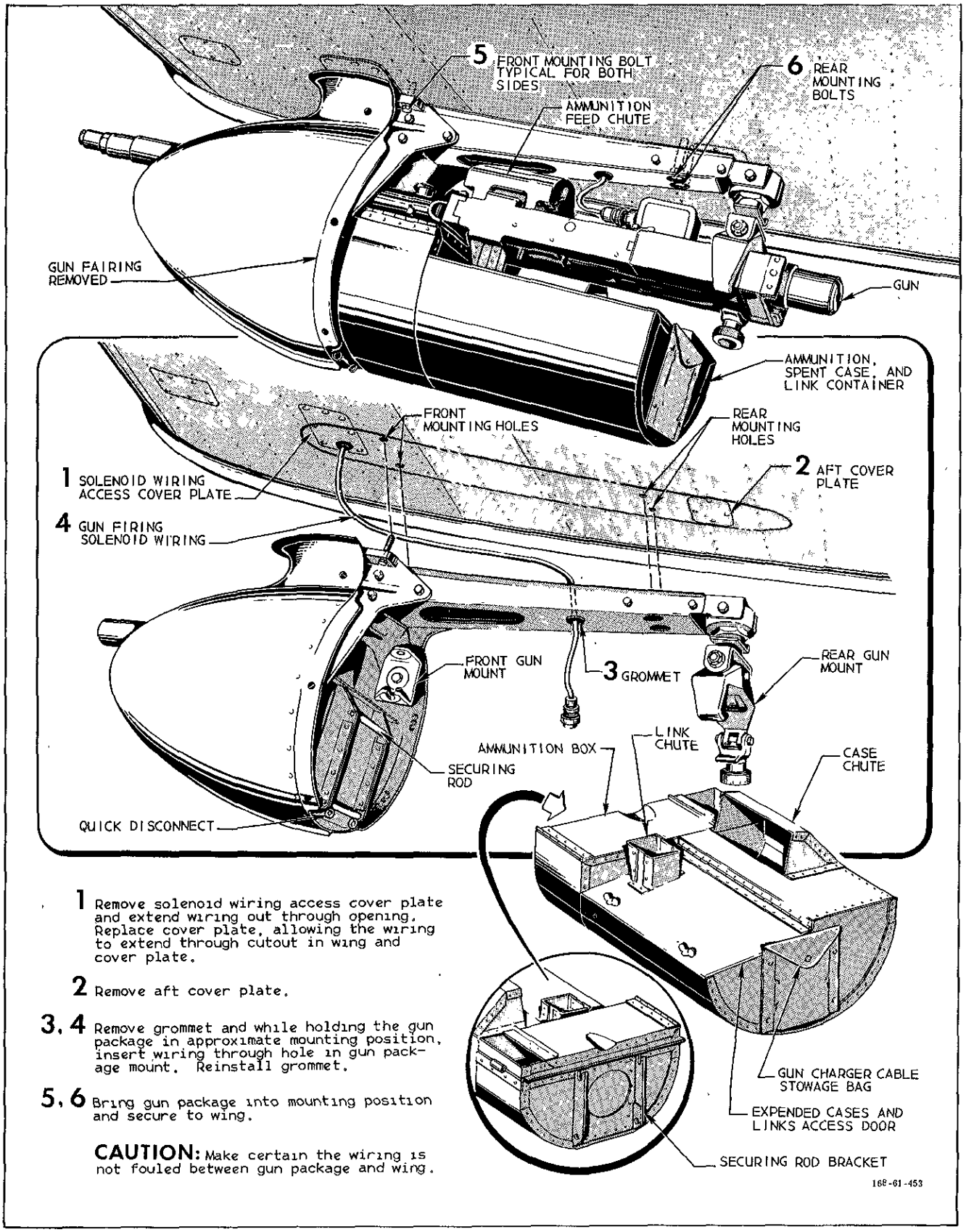

Figure 4-75. Installing Gun Package and Guns

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Figure 4-76 (Sheet 1 of 2 Sheets). Harmonizing Guns, Sight, and Cameras

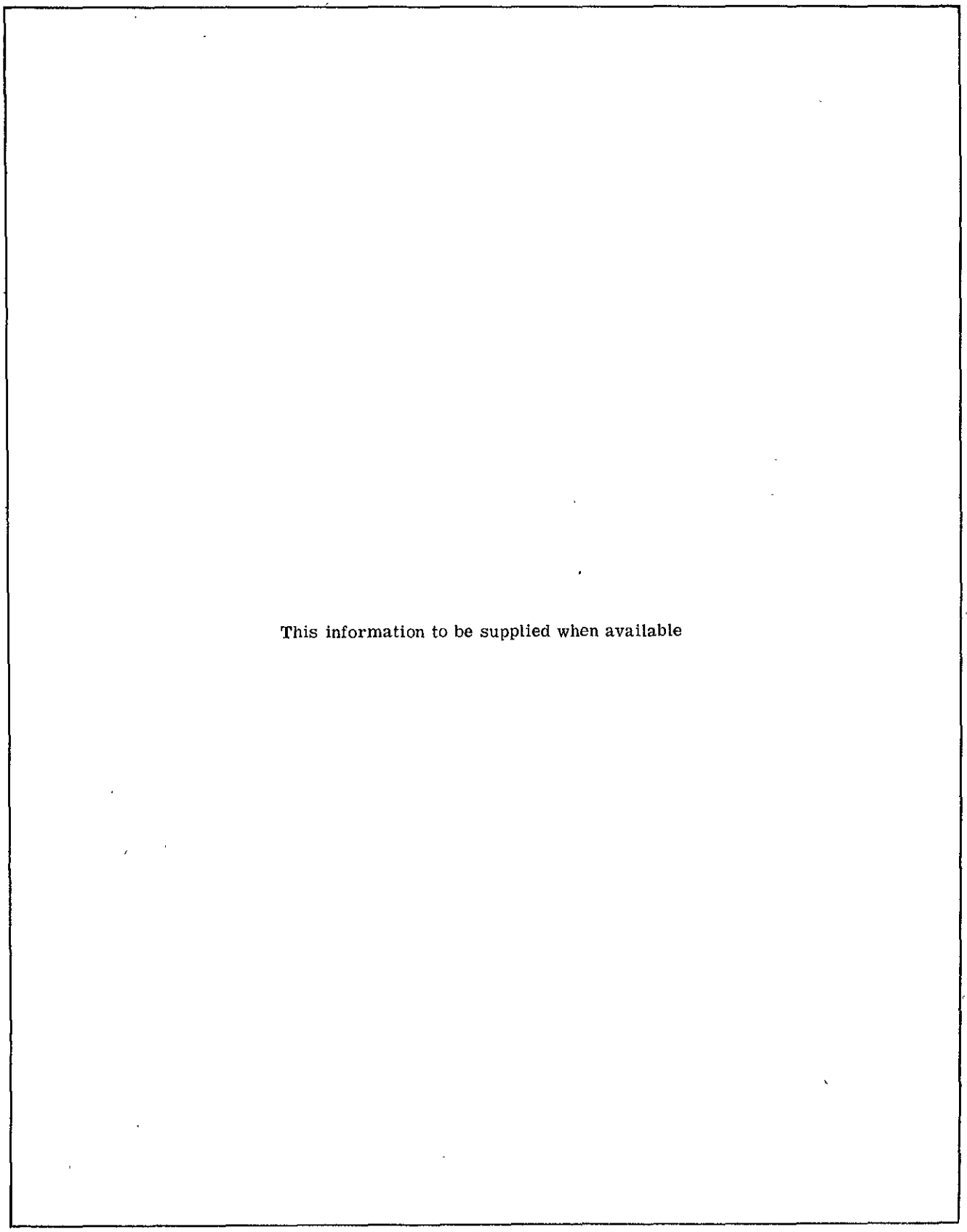


Figure 4-76 (Sheet 2 of 2 Sheets). Harmonizing Guns, Sight, and Cameras

reticle reflector glass is controlled by a knob that also positions an indicating dial. Cam stops on the knob drive shaft are adjusted so that the dial may be set in the proper position for gun, rocket, or bomb aiming.

4-534. GUN CAMERA.

4-535. A Type AN-N6 gun camera is mounted in the left wing at station 69.75 just inboard of the rocket camera. (See figure 4-73.) The gun camera is the same type as used in the rocket system. (Refer to paragraph 4-517 for camera operation.)

4-536. REMOVING GUN CAMERA. Procedure is identical to removal of rocket camera. (Refer to paragraph 4-518.)

4-537. INSTALLING GUN CAMERA. See figure 4-76.

SECTION V

MILITARY LOAD

5-1. LOADING AMMUNITION.

5-2. The Type M-2 gun in each of the two gun packages is normally fed by 250 rounds of .30-caliber ammunition. The ammunition is stowed in a removable ammunition box contained within the gun package. Ejected cases and links are retained in separate compartments attached to the aft end of the ammunition box. To load ammunition, proceed as follows:

a. Load ammunition in container.

b. Open gun cover.

c. Engage feed chute with gun.

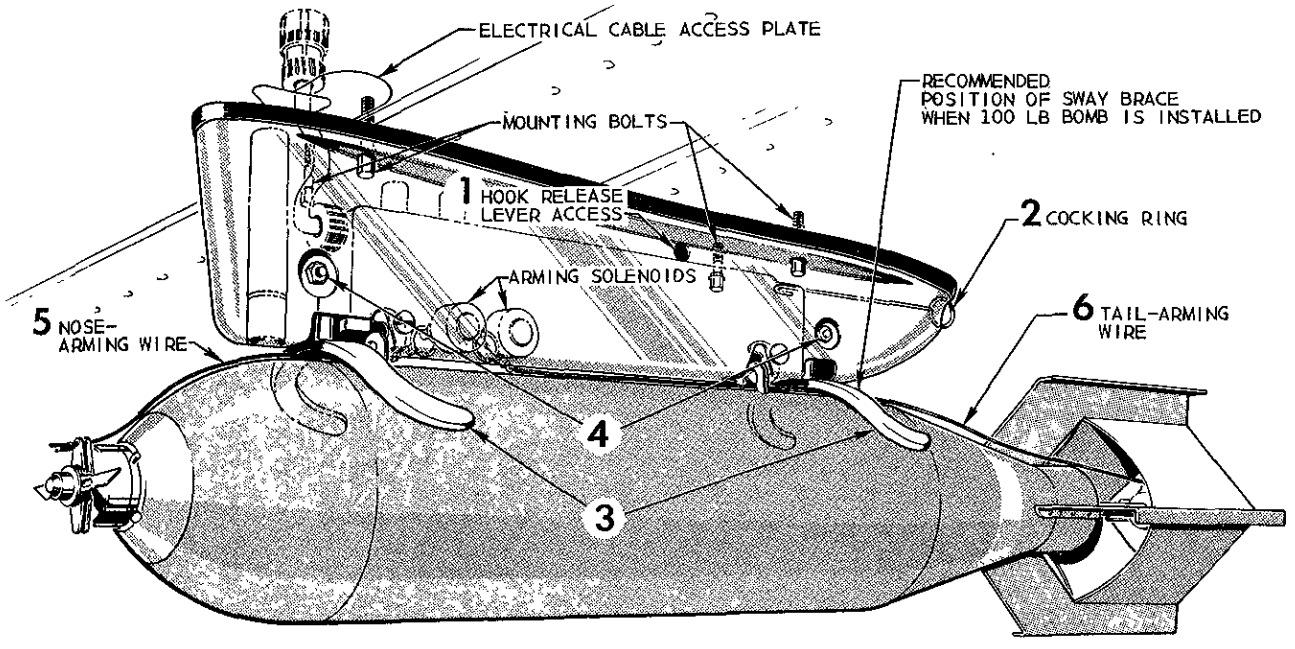
d. Install ammunition box by engaging slotted bracket on forward end of ammunition box with the support rod on the gun package. Engage quick-disconnect to secure ammunition box. (See figure 4-75.)

e. Connect lower end of ammunition chute to ammunition container.

f. From container, slide ammunition up the chute and engage ammunition in gun. Close gun cover and charge gun.

5-3. LOADING BOMBS OR ROCKET LAUNCHER ONTO BOMB RACKS.

5-4. Each wing bomb rack will accommodate one 100-pound bomb. The two outboard bomb racks will



1 If rack release hooks are closed, open them by inserting a rod or similar device into the opening in the top left side of the bomb rack fairing and tripping the hook release lever located therein.

2 When the unit being loaded has been lifted into place, with the support lugs positioned in the release hook slots of the bomb rack, pull the cocking ring at the end of the rack. This will cause the bomb hooks to rotate around the lugs on the unit until they lock.

3, 4 Place sway braces in bearing on bomb being loaded, and tighten the sway brace lock bolts.

5, 6 Connect nose-and tail-arming wires to arming solenoids.

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Figure 5-1. Installing Bombs

each accommodate a rocket launcher assembly. Make sure that the bomb rack releasing system performs correctly; then proceed as shown in figure 5-1.

5-5. LOADING 2.25-INCH SCA ROCKETS.

5-6. Prior to installing rockets, inspect the launcher assembly for security of mounting and for general over-all condition. Test the operation of the release and jettisoning circuits. Make sure a continuity check has been accomplished on each rocket circuit (using a Type 680A continuity tester); then load the rockets as follows:

CAUTION

Only authorized personnel are to be permitted near the airplane during, and subsequent to, rocket loading.

a. Make sure that bomb-rocket selector is in "OFF" position and that projector release is positioned to "1."

b. Load rockets on launcher as detailed in figure 5-2.

c. Check the electrical firing circuit as outlined in paragraph 4-505.

WARNING

If the tester indicates a glow, even slight or momentary, from a lamp out of proper sequence, the mission must be cancelled until the malfunction is rectified.

d. After engine is started prior to taxiing, and while airplane is pointed toward an uninhabited area containing no buildings, plug each rocket igniter lead into its receptacle on the launcher assembly. The plug-in is to be accomplished by a predesignated man upon a signal from the pilot and in an area cleared of personnel.

WARNING

The armorer must stand at the side of the rocket being plugged in, never behind the rocket being plugged in nor immediately behind or in front of any rocket already plugged in. Signal pilot when plug-in operations are completed.

5-7. LOADING 5-INCH HVAR ROCKETS.

5-8. Prior to loading rockets on launchers, inspect front and rear mounts for damage. Make certain the mounts are firmly secured; make sure that launching slots in front mounts are not obstructed, that rear mount release latches operate freely, and that a thorough continuity check has been accomplished on each electrical firing ciruit. (Refer to paragraph 4-503.) Check all armament switches to make sure they are in the "OFF" position; then install rockets as shown in figure 5-3. After rockets have been loaded, observe the same safety rules as outlined in paragraph 5-6, steps c. and d.

5-9. LOADING AND PREPARING GUN AND ROCKET CAMERAS FOR USE.

5-10. Film can be loaded and camera settings can be adjusted without removal of camera mount. Prior to loading the camera, make the following checks:

a. Be sure that cameras are bore sighted properly.

b. Make sure cameras are in proper working order. (Camera operation may be checked while camera is installed in the airplane, or it may be bench-tested.)

c. Clean the lens and filter on each camera. (Cleanliness of these items is a very important factor in obtaining satisfactory pictures.)

d. If necessary, set overrun control to predetermined requirements for overrun time. (Overrun setting may be seen through window in camera case.)

e. Check the number of feet of unused film in the magazine, and set film footage dial on camera accordingly. If a full magazine is to be used, turn the footage indicator knob until the footage dial indicates "0." If the film is partially used, set footage indicator to correspond to the figure on the film magazine footage dial. In order to set the film footage dial, it is necessary to push in while turning the dial knob.

f. Press the buttons on both ends of the camera magazine access cover, and open the cover. Retract the magazine drive gear engagement arm out of the way, to allow for magazine loading. Insert the film magazine all the way into the magazine chamber, with the aperture toward the lens and the footage indicator toward the mounting side of the camera. Taking care not to force the driving gears into engagement, rotate the magazine drive gear engagement arm over the end of the magazine. Drive gears should engage smoothly. Close magazine access cover.

NOTE

The magazine access cover will not close unless the magazine drive gear engagement arm is in engaged position. As the film magazine is inserted into the camera, the film opening in the magazine is pushed open automatically.

g. Set shutter speed as required (16, 32, or 64 frames per second), by turning shutter speed knob on side of the camera.

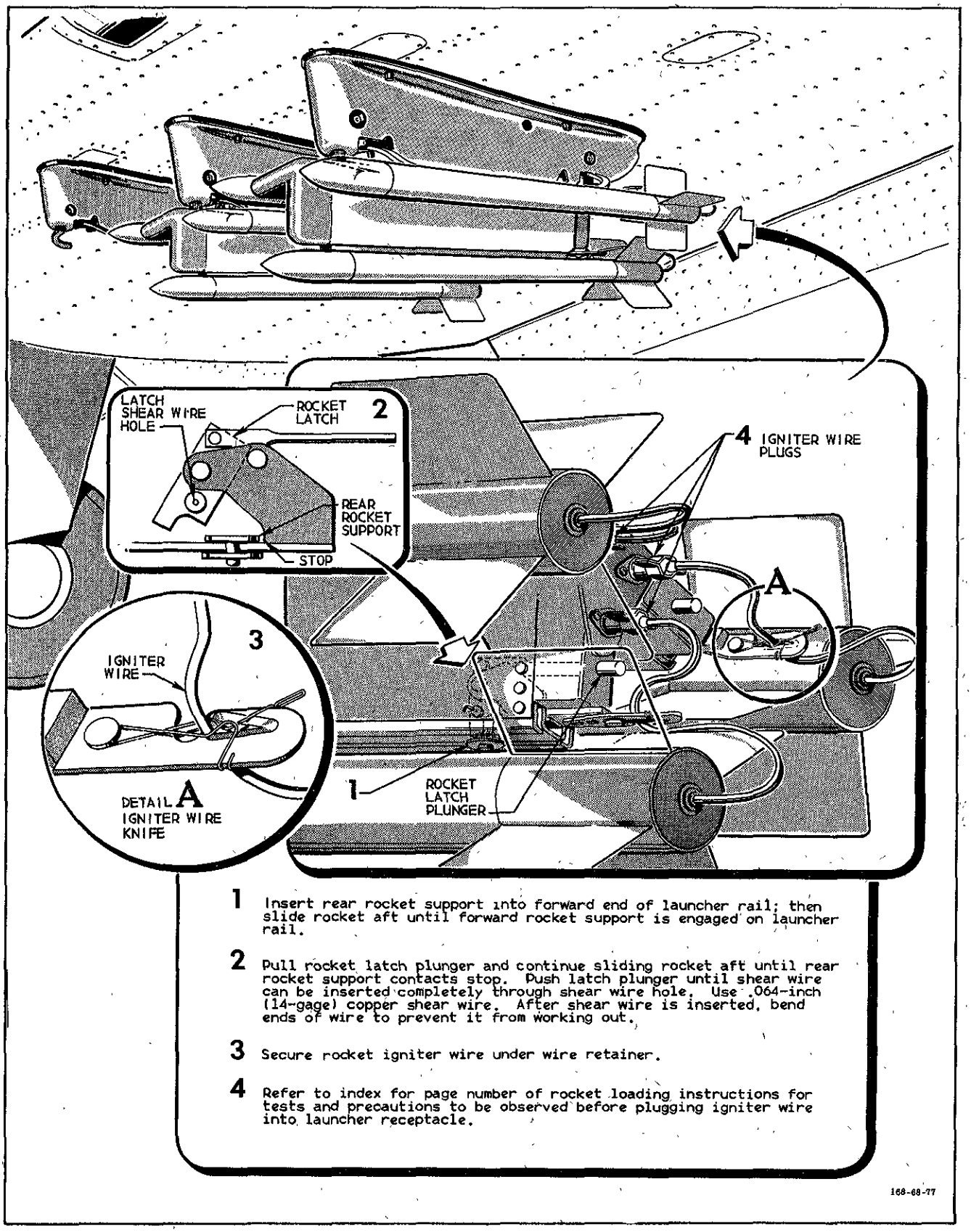
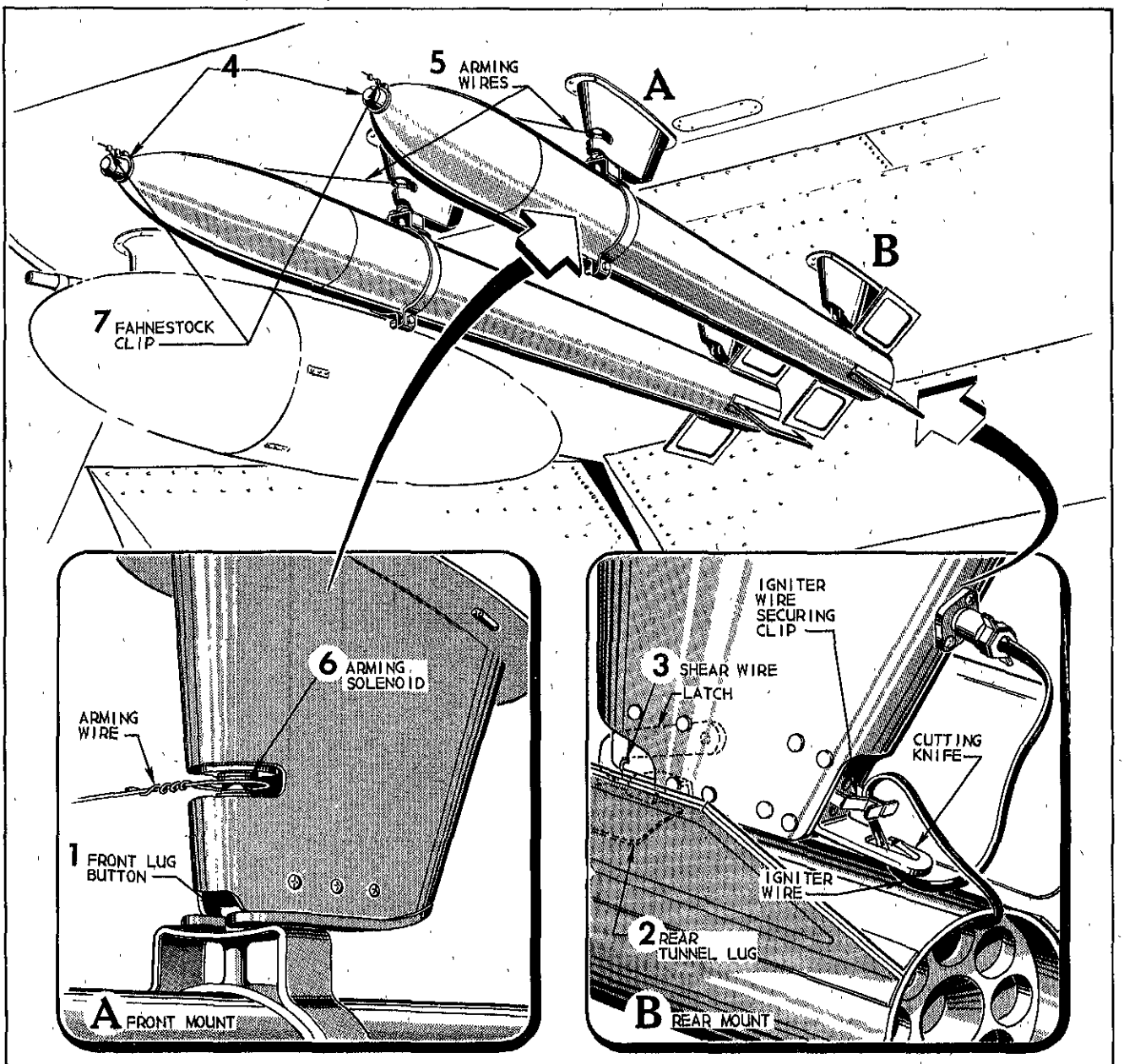


Figure 5-2. Installing 2.25-inch SCA Rocket



1, 2 Raise rear mount latch and fit front lug button and rear tunnel lug into mounts simultaneously.

3 Insert shear wire and bend ends down. Use .064-inch diameter brass standard bomb arming wire 2 inches long.

4 If MK 149 nose fuse is to be used, make sure auxiliary booster is in fuse liner of shell; then screw fuse into fuse liner ring with spanner wrench.

5 Turn fuse clamp so that clamp pin and bushing are on the same side of the fuse as arming wire, and insert arming wire in the hole next to the safety wire.

6 Insert arming wire swivel-loop into the fuse-arming solenoid.

7 Install Fahnestock clip on free end of arming wire, and slide clip up to the clamp bushing. Cut off excess arming wire, leaving 3 to 4 inches in front of fuse. Remove safety wire.

168-68-78

Figure 5-3. Installing 5-inch HVAR Rockets

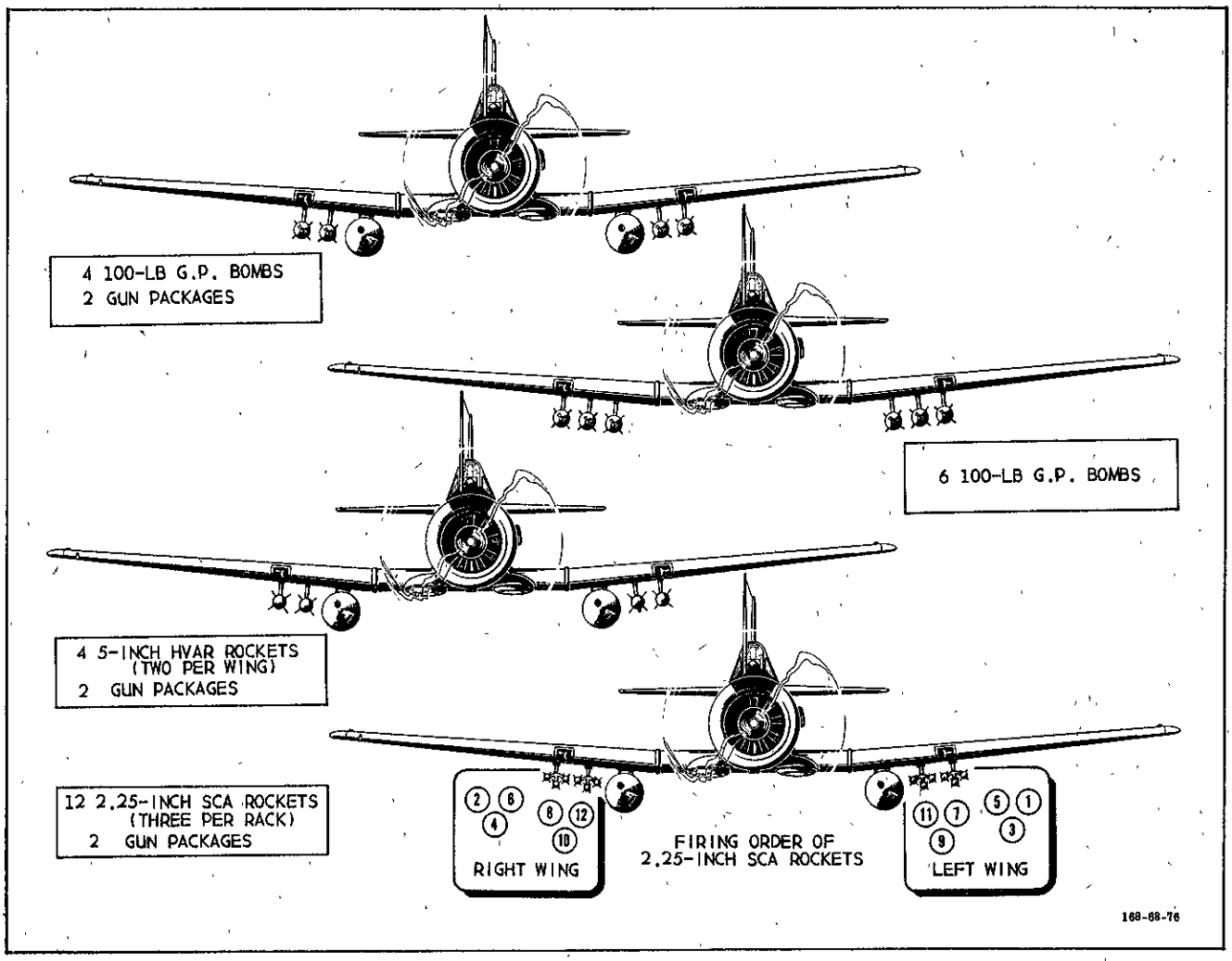


Figure 5-4. Loading Arrangements for Bombs, Rockets, and Gun Package

WARNING

Do not change shutter speed while camera is running, and always have the index marks on the shutter speed knob in exact alignment with the index mark on the side of camera.

h. Rotate outer adjustment ring until diaphragm opening guide corresponds to shutter speed setting (either 16, 32, or 64).

NOTE

The shutter speed knob must always be set at the same speed as that of the diaphragm opening guide of the lens.

i. Rotate inner knurled adjustment ring to anticipated light condition - "B" (bright), "H" (hazy), "D" (dull), or 3.5 (the maximum aperture for adverse light conditions).

j. Close and fasten the dzus-fastened access door.

5-11. UNLOADING GUN CAMERA.

a. Press cover release buttons on access cover, and swing cover open.

b. Rotate magazine drive gear retracting arm into camera body, thereby disengaging magazine drive gears.

c. Pull film magazine out. The film opening in the magazine is automatically closed when the magazine is withdrawn.

SECTION VI

CHARTS AND TABLES

6-1. FLEXIBLE CABLE MANUFACTURING CHART.

6-2. The following table gives complete information for the manufacturing of all flexible cable assemblies shown in figure 6-1:

NAA NO.	CABLE ASSEMBLY (Make all cables from AN-RR-C-48.)	TYPE	FITTING "A"	CABLE DIA IN INCHES	FITTING "B"	LENGTH "L" IN INCHES	ADDITIONAL FITTINGS AS NOTED
168-52412 (1 Reqd)	Rudder Control - Rear RH	I	AN668-4	1/8	AN669S4LH	63-3/8	AN155-32S AN161-22RS
168-52411 (1 Reqd)	Rudder Control - Rear LH	I	AN668-4	1/8	AN669S4LH	63-11/16	AN155-32S AN161-22RS
(Deleted)							
168-52413 (1 Reqd)	Rudder Control - Front LH	I	AN668-4	1/8	AN669S4LH	161-5/16	AN155-32S AN165-22S
168-52414 (1 Reqd)	Rudder Control - Front RH	I	AN668-4	1/8	AN669S4LH	161-1/8	AN155-32S AN165-22S
88-52461 (1 Reqd)	Rudder Balance	III	AN165-16S	3/32	AN668-3	112-7/16	AN669-53LH AN155-16S AN165-16S 1LI Nut
66-52538-5 (1 Reqd)	Rudder Trim - Rear	IX	1T2-L	1/16	AN668-2	197-7/8	AN155-16S AN668-2 AN23-10 AN320-3 AN161-16LS AN380-2-2 AN960-10L
168-52525 (1 Reqd)	Rudder Trim - Front	X	1T2R	1/16	1T2R	347-1/2	
121-52217	Elevator Control - Front Lower	VIII	AN668-4	1/8	AN669S4RH	215-7/32	
121-52218	Elevator Control - Front Upper	VIII	AN668-4	1/8	AN669S4RH	173-11/32	
121-52219 (2 Reqd)	Elevator Control - Rear	I	AN668-4	1/8	AN669S4LH	45-19/32	AN155-32S
(Deleted)							
66-52527-5 (1 Reqd)	Elevator Trim - Rear	IX	1T2-L	1/16	AN668-2	233-7/8	AN155-16S AN161-16RS AN161-16LS AN23-10 AN320-3 AN380-2-2 AN96010L
(Deleted)							
66-52528 (1 Reqd)	Elevator Trim - Front	I	AN669-8D-2LH	1/16	AN669-8D-2RH	306-15/16	NAA66-52532 AN23-8 AN320-3 AN380-2-2
121-52313 (2 Reqd)	Aileron Control - Outer Wing Rear	I	AN668-4	1/8	AN669S4LH	76-3/32	
121-52312 (2 Reqd)	Aileron Control - Outer Wing Front	I	AN668-4	1/8	AN669S4LH	75-5/32	
121-52311 (2 Reqd)	Aileron Control - Wing Center Section Rear	VIII	1T1	1/8	AN669S4RH	90-5/32	AN155-32S
121-52310 (2 Reqd)	Aileron Control - Wing Center Section Front	VIII	1T1	1/8	AN669S4RH	92-9/16	AN155-32S
88-34160-4 (1 Reqd)	Tail Wheel Control - RH	IX	AN667-5	5/32	AN669-85LH	40-1/8	AN160-32S AN155-32S
88-34160-5 (1 Reqd)	Tail Wheel Control - LH	IX	AN667-5	5/32	AN669-85LH	39-3/4	AN160-32S AN155-32S

NAA NO.	CABLE ASSEMBLY (Make all cables from AN-RR-C-48.)	TYPE	FITTING "A"	CABLE DIA IN INCHES	FITTING "B"	LENGTH "L" IN INCHES	ADDITIONAL FITTINGS AS NOTED
168-45006 (1 Reqd)	Manual Starter Engaging Control		77-45039	1/16	77-45042	17-7/16	
77-33450 (1 Reqd)	Parking Brake	V	AN668-2	1/16	AC066135	25-15/16	
66-33476-3 (2 Reqd)	Rear Brake - Rear Rudder	VIII	AN668-5	5/32	AN669-S5RH	72-11/32	AN155-32S AN161-32LS
66-33477 (2 Reqd)	Front Brake - Front Rudder	III	AN668-5	5/32	AN668-5	12-5/8	

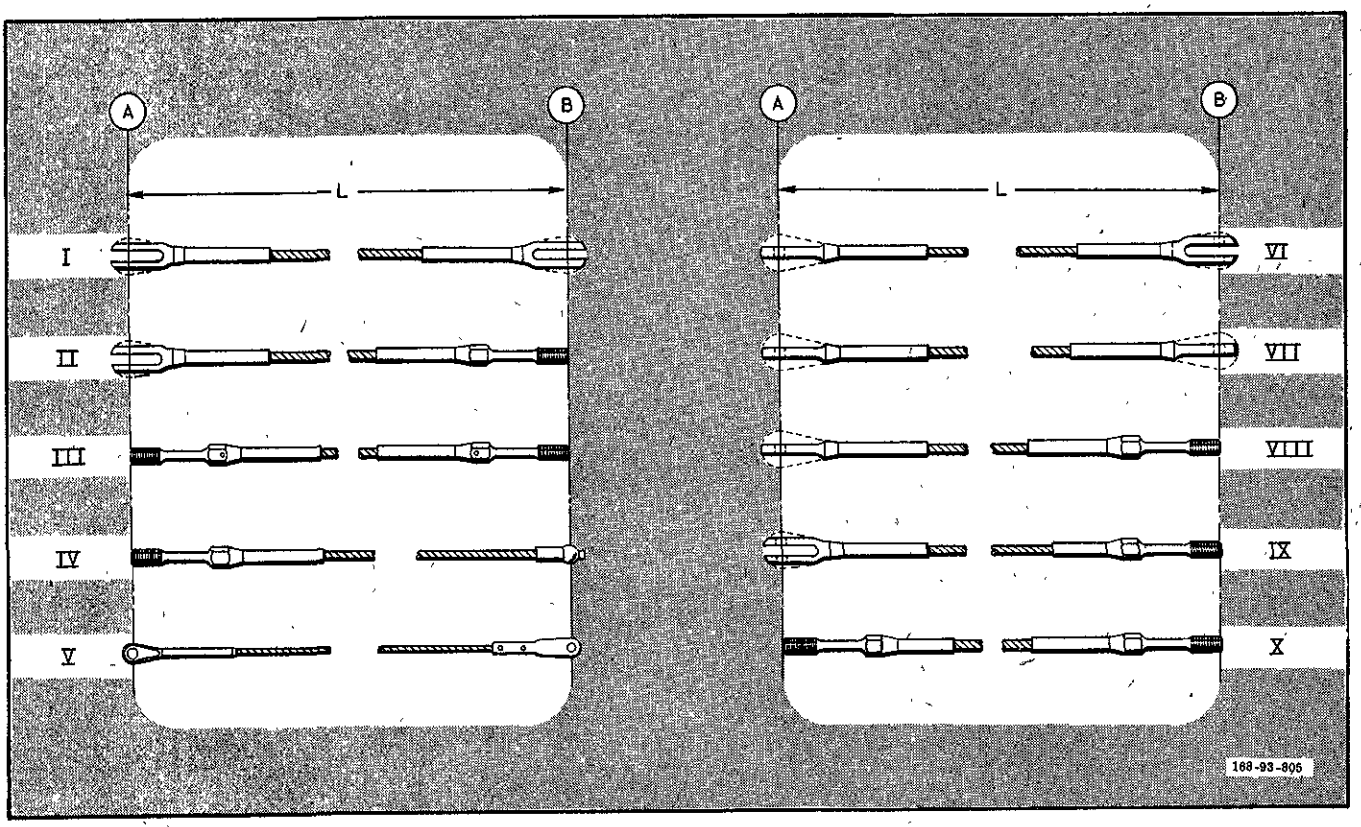


Figure 6-1. Cable Manufacturing Chart

6-3. CONTROL ROD MANUFACTURING CHART.

6-4. See figure 6-2 for information on the manufacturing of those control rods that can be fabricated in the field. All other rod assemblies used in this airplane are of such nature that they cannot be produced locally, as they require special processing, fixtures, or forming equipment.

NAA NO.	ROD ASSEMBLY	TYPE	FITTING "A"	TUBE DIA & SPEC NO.	FITTING "B"	LENGTH "L" IN INCHES	LENGTH "L_1" IN INCHES	LENGTH "L_2" IN INCHES	ADDITIONAL FITTINGS AS NOTED	NOTES
66-33594 (1 Reqd)	Landing Gear Lockpin Left Control	II	REB3N	3/8 OD x .035 AN-WW-T-846 1025 Steel Tube	REB3N	10-7/8	5-3/4	1/8	1R2-6 (2 Reqd) AN316-4R Nut (2 Reqd)	Fusion weld and trim off smooth, both ends.
66-33592 (1 Reqd)	Landing Gear Lockpin Right Control	II	REB3N	3/8 OD x .035 AN-WW-T-846 1025 Steel Tube	REB3N	11-1/8	6	1/8	1R2-6 (2 Reqd) AN316-4R Nut (2 Reqd)	Fusion weld and trim off smooth, both ends
66-33593 (1 Reqd)	Landing Gear Lock Center Section Left Control	II	REB3N	3/8 OD x .035 AN-WW-T-846 1025 Steel Tube	REB3N	22-7/16	17-5/16	1/8	1R2-6 (2 Reqd) AN316-4R Nut (2 Reqd)	Fusion weld and trim off smooth, both ends.
66-33565 (1 Reqd)	Landing Gear Lock Control Push	II	REB3N	9/16 OD x .035 1025 Steel Tube	REB3N	61-9/16	56-3/16	1/8	B1368-9 (2 Reqd) AN316-4R Nut (2 Reqd)	Fusion weld and trim off smooth, both ends.
66-33539 (1 Reqd)	Landing Gear Up Position Latch Control	II	AN486-1	1/2 OD x .035 1025 Steel Tube	AN486-1	19-5/8	14	1/8	1R2-8 (2 Reqd) AN316-4R Nut (2 Reqd)	Resistance weld and trim off smooth, both ends
66-33591 (1 Reqd)	Landing Gear Fuselage To Center Section Control	II	REB3N	1/2 OD x .035 1025 Steel Tube	REB3N	17-3/16	12-9/16	1/8	1R2-8 (2 Reqd) AN316-4R Nut (2 Reqd)	Resistance weld and trim off smooth, both ends

NAA NO.	ROD ASSEMBLY	TYPE	FITTING "A"	TUBE DIA & SPEC NO.	FITTING "B"	LENGTH "L" IN INCHES	LENGTH "L_1" IN INCHES	LENGTH "L_2" IN INCHES	ADDITIONAL FITTINGS AS NOTED	NOTES
88-44601 (1 Reqd)	Propeller Firewall To Engine Control	II	U-2275	3/8 OD x .035 AN-WW-T-846 1025 Steel Tube	U-2275	23-7/16	18-13/16	1/8	1R2-6 (2 Reqd) AN316-4R Nut (2 Reqd)	Resistance weld and trim off smooth, both ends.
168-43802 (1 Reqd)	Engine Throttle Control	II	1R2-6	3/8 OD x .035 AN-WW-T-846 1025 Steel Tube	168-43007	28-9/16	23-5/16	3/8	B1388-6 (2 Reqd) AN316-4R Nut (2 Reqd)	Resistance weld and trim off smooth, both ends.
88-43805 (1 Reqd)	Carburetor Air Firewall To Mixing Chamber Control	II	U-2275	3/8 OD x .035 AN-WW-T-846 1025 Steel Tube	U-2275	27-3/16	22-1/16	1/8	1R2-6 (2 Reqd) AN316-4R Nut (2 Reqd)	Fusion weld and trim off smooth, both ends.
88-52625 (2 Reqd)	Flap Equalizer Control	V	88-52618	5/8 OD x .065 WV -T-785 Cond T 24ST Al Alloy Tube	88-52618	16	12-7/8	5/16	AN3-11A Bolt (2 Reqd) AC365-1032 Nut (2 Reqd)	Drill No. 11 (.191) two places in -2 tube after assembly.
19-48039-2 (1 Reqd)	Fuel Cock Control	X	None	3/8 OD x .058 AN-WW-T-846 1025 Steel Tube	None	28-5/8	26-5/8	5/8		"L_1" dimension machined to .373 (+.000/-.001), both ends.
34-48039-4 (1 Reqd)	Fuel Cock Control	X	None	3/8 OD x .058 AN-WW-T-846 1025 Steel Tube	None	28-5/8	26-5/8	5/8		"L_2" dimension machined to .373 (+.000/-.001), both ends.
65-52535-3 (1 Reqd)	Trim Tab Push	VIII	REB3-1	5/16 24ST Al Alloy	REB3-1	13-1/16	11-1/16	13/16	AN316-4R Nut (2 Reqd)	Chamfer 45 degrees x 1/32 in. both ends. Thread 1/4-28NF-3 both ends, PD .2268 (+.000/-.0022).
55-52535-5 (1 Reqd)	Trim Tab Push	VIII	REB3-1	5/16 24ST Al Alloy	REB3-1	14-7/16	12-7/16	13/16	AN316-4R Nut (2 Reqd)	Chamfer 45 degrees x 1/32 in. both ends. Thread 1/4-28NF-3 both ends. PD .2268 (+.0000/-.0022).
55-54127 (1 Reqd)	Throttle Switch Actuating	III	AN486-3	1/4 x 1020	U-2275	8	6-3/4	15/16	AN316-4R Nut (2 Reqd)	Thread 1/4-28NF-3, PD .2268 (+.0000/-.0022). Chamfer ends 45 degrees x 1/32 in.
55-52428 (2 Reqd)	Rudder Pedal Brake Operating	VIII	AN665-34R	1/4 4037 Steel AN-8-9	AN665-34R	11-11/16	9-15/16	1-5/8	AN315-4R Nut (1 Reqd) AN315-4L Nut (1 Reqd)	Thread 1/4-28NF-3 RH. PD .2268 (+.0000/-.0022). Thread 1/4-28NF-3 LH. PD .2268 (+.0000/-.0022).
88-52315 (2 Reqd)	Outer Wing Aileron Control	IX	88-52316-3	3/4 OD x .049 AN-A-13T 24ST Al Alloy Tube	88-52314	22-21/64	18-61/64	1/2	AN442AD5 Rivet (4 Reqd)	1-7/8 in. dimension. Drill No. 21 (.159) four places (typical).
88-52575 (4 Reqd)	Aileron Trim Tab Control	VI	88-52577	3/8 OD x .035 1025 Steel Tube AN-WW-T-846	88-52576	11-1/8	8-5/8	1/8	AN316-4R Nut (1 Reqd) 88-52578 (1 Reqd)	Resistance weld and trim smooth, both ends.

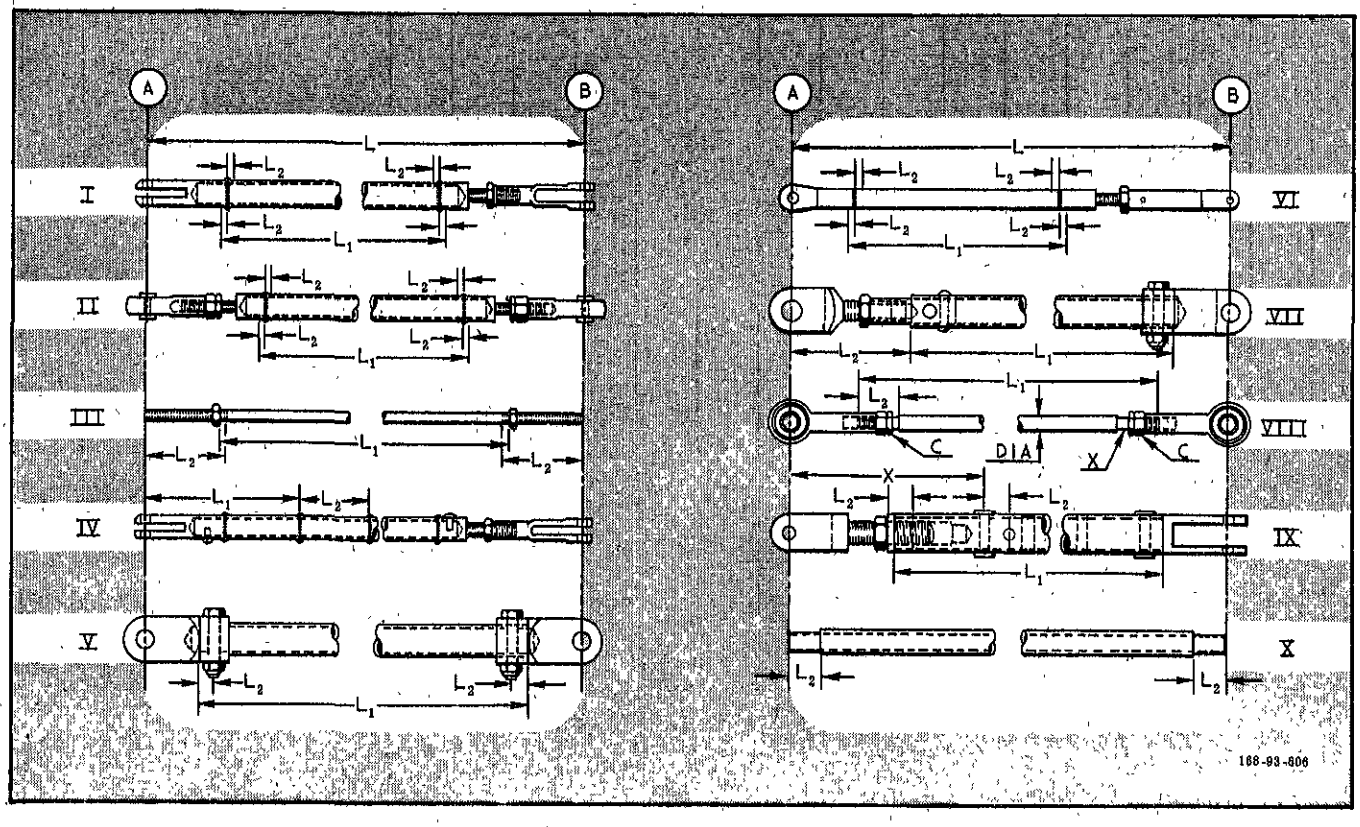


Figure 6-2. Rod Manufacturing Chart

6-5. TORQUE TABLES.

6-6. TORQUES.

6-7. To avoid overstressing bolts, it is necessary to torque the nuts. Because of the variables involved, nuts have been frequently overtightened. Variables that occur in torquing bolts are the friction of the bolt in the hole and the friction of the bolt head engaging the work; those occurring in torquing nuts are the friction of the thread and the surface of the nut as it engages the work. Each variable has been determined within safe limits as covered by the ensuing tables, and these values should be followed unless a specific exception requires a specific torque for a given nut or bolt. See figure 6-3 for tabular list of AN. nuts and NAS series bolts.

BOLT OR SCREW SIZE		TORQUE VALUES IN INCH-POUNDS (1) FOR TIGHTENING NUTS (2) (3)		
		ON STANDARD BOLTS AND SCREWS HAVING A TENSILE STRENGTH OF 125,000-140,000 PSI		ON HIGH STRENGTH BOLTS AND SCREWS HAVING A TENSILE STRENGTH 160,000 PSI & OVER
		SHEAR-TYPE NUTS (4) (AN320, AN364, OR EQUIVALENT)	TENSION-TYPE NUTS AND THREADED MACHINE PARTS (AN310, AN365, OR EQUIVALENT)	ANY TYPE NUT
8-32	8-36	7- 9	12-15	15-18
10-24	10-32	12-15	20-25	25-35
1/4-20		25-30	40-50	50-68
	1/4-28	30-40	50-70	70-90
5/16-18		48-55	80-90	90-144
	5/16-24	60-85	100-140	140-203
3/8-16		95-110	160-185	185-248
	3/8-24	95-110	160-190	190-351
7/16-14		140-155	235-255	255-428
	7/16-20	270-300	450-500	500-756
1/2-13		240-290	400-480	480-792
	1/2-20	290-410	480-690	690-990
9/16-12		300-420	500-700	700-990
	9/16-18	480-600	800-1,000	1,000-1,440
5/8-11		420-540	700-900	900-1,350
	5/8-18	660-780	1,100-1,300	1,300-2,160
3/4-10		700-950	1,150-1,600	1,600-2,250
	3/4-16	1,300-1,500	2,300-2,500	2,500-4,500
7/8-9		1,300-1,800	2,200-3,000	3,000-4,140
	7/8-14	1,500-1,800	2,500-3,000	3,000-6,300
1-8		2,200-3,000	3,700-5,000	5,000-6,840
	1-14	2,200-3,300	3,700-5,500	5,500-9,000
1-1/8-8		3,300-4,000	5,500-6,500	6,500-10,800
	1 1/8-12	3,000-4,200	5,000-7,000	7,000-13,500
1-1/4-8		4,000-5,000	6,500-8,000	8,000-14,000
	1 1/4-12	5,400-6,600	9,000-11,000	11,000-22,500

NOTE:

(1) To obtain values in foot-pounds, divide inch-pound values by 12.

(2) When nuts are to be secured to the fastener with cotter pins or lock-wire, tighten the nut to the low side of selected torque range and, if necessary, continue tightening until the next slot aligns with the hole. Do not loosen nuts to obtain alignment.

(3) When it is necessary to tighten the fastener from the bolt or screw head, the high side of the selected torque range is recommended and the maximum torque shall not exceed 10 percent above the high side of the selected torque range listed in the table.

(4) For corrosion-resistant steel nuts, use torque values given for shear-type nuts.

153-93-800

Figure 6-3. Torque Table

6-8. TUBING TORQUES. The following table lists torque values (in inch-pounds) for AN. type tubing fittings:

NOTE

Tighten these nuts carefully, as overtightening may completely cut off or severely damage the tube flare, and undertightening may cause the line to blow out.

TUBING DIAMETER (IN.)	WRENCH SIZE (IN.)	AL ALLOY TUBING		STEEL TUBING	
		MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
1/8	3/8	20	25		
3/16	7/16	25	35	30	70
1/4	9/16	40	65	50	90
5/16	5/8	60	80	70	120
3/8	11/16	75	125	90	150
1/2	7/8	150	250	155	250
5/8	1	200	350	300	400
3/4	1-3/16	300	500	430	575
1	1-1/2	500	700	550	750
1-1/4	1-15/16	600	900		
1-1/2	2-1/4	600	900		
1-3/4	2-5/8	700	1000		
2	2-15/16	800	1100		

6-9. HOSE-CLAMP TIGHTENING.

6-10. All hose clamps are to be tightened finger-tight prior to final assembly. In final assembly, all clamps installed on self-sealing hose are to be torqued to 15 inch-pounds and all clamps installed on non-self-sealing hose are to be torqued to 25 inch-pounds, at which time the connections should be examined carefully to be sure the clamps are located in proper relation to the beads and that the clamps are normal to the centerline of the tube. Clamps should be located relative to fitting and/or beaded tube ends as shown in figure 6-4. For retightening loose hose clamps in service, proceed as follows:

a. Non-self-sealing hose - If the hose clamp screw cannot be tightened with the fingers, do not disturb unless leakage is evident. If leakage is present, tighten one-fourth turn.

b. Self-sealing hose - If the hose clamp screw is looser than finger-tight, tighten to finger-tight and add one-fourth turn.

6-11. COLOR CODE.

6-12. The following table lists the color coding for aircraft tubing used in the airplane:

LINE	COLOR BAND
Fuel	Red
Hydraulic fluid	Blue-Yellow-Blue
Manifold pressure	White-Blue
Oil	Yellow
Pitot-Pressure - airspeed	Black
Static-Pressure - airspeed, altimeter, and rate of climb	Black-Green
Vacuum	White-Green

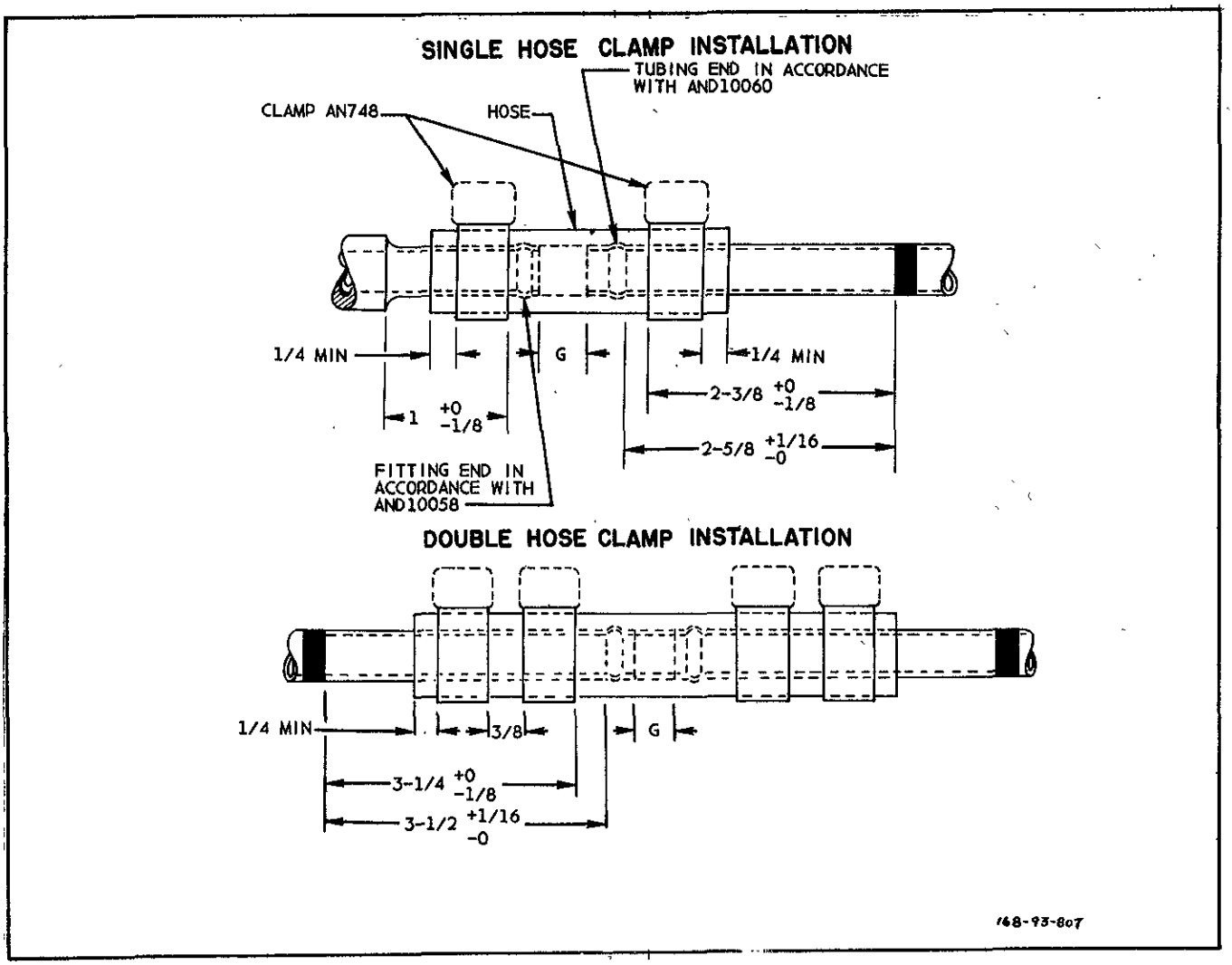


Figure 6-4. Hose-Clamp Installation

SECTION VII

MAINTENANCE INSPECTION

For maintenance inspection refer to the applicable Handbook of Inspection Requirements.

SECTION VIII

ELECTRICAL AND ELECTRONIC WIRING DIAGRAMS

8-1. ELECTRICAL AND ELECTRONIC WIRING DIAGRAMS.

8-2. This section of the book contains wiring diagrams for the electrical and electronic systems of the airplane. Isometric illustrations supplement the electrical and electronic diagrams to show actual location of all major items listed on each diagram. The item list included with each diagram lists the part number and gives a description of each individual electrical and electronic component.

8-3. ELECTRICAL AND ELECTRONIC WIRING DIAGRAM INDEX.

TITLE	DIAGRAM IDENTIFICATION	PAGE
Circuit Breaker and Relay Location Chart (Sheet 1 of 4 Sheets)		152
Circuit Breaker and Relay Location Chart (Sheet 2 of 4 Sheets)		152A
Circuit Breaker and Relay Location Chart (Sheet 3 of 4 Sheets)		152B
Circuit Breaker and Relay Location Chart (Sheet 4 of 4 Sheets)		153
Electrical Symbol Chart (Sheet 1 of 4 Sheets)		154
Electrical Symbol Chart (Sheet 2 of 4 Sheets)		155
Electrical Symbol Chart (Sheet 3 of 4 Sheets)		156
Electrical Symbol Chart (Sheet 4 of 4 Sheets)		157
D-C Power Control and Distribution - Airplanes AF49-2897 Through AF49-3226	1.1	158
D-C Power Control and Distribution - Airplanes AF49-3227 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	1.01	158B
D-C Power Control and Distribution - Airplanes AF49-3538 Through AF49-3596	1.01A	158D
D-C Power Control and Distribution - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C1.1	158F
Starter and Ignition System - Airplanes AF49-2897 Through AF49-3226	3.1	160
Starter and Ignition System - Airplanes AF49-3227 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	3.01	160B
Starter and Ignition System - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C3.1	160D
Landing Gear, Lights, and Horn - Airplanes AF49-2897 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	5.1	162
Landing Gear, Lights, and Horn - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C5.1	162B

TITLE	DIAGRAM IDENTIFICATION	PAGE
Fuel Low-level Warning System - Airplanes AF49-2897 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	7.1	164
Fuel Low-level Warning System - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C7.1	164B
Remote Compass and Tachometer Indicators - Airplanes AF49-2897 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	9.1	166
Remote Compass and Tachometer Indicators - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C9.1	166B
Navigation, Cowl, and Landing Lights - Airplanes AF49-2897 Through AF49-3226	11.1	168
Navigation, Cowl, and Landing Lights - Airplanes AF49-3227 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	11.01	168B
Navigation, Cowl, and Landing Lights - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C11.1	168D
Oil Dilution, Gyro Control, Passing Light, and Pitot Heater - Airplanes AF49-2897 Through AF49-3226	13.1	170
Oil Dilution, Gyro Control, Passing Light, and Pitot Heater - Airplanes AF49-3227 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	13.01	170B
Oil Dilution, Gyro Control, Passing Light, and Pitot Heater - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C13.1	170D
Cockpit and Fuel Gage Lights - Airplanes AF49-2897 Through AF49-3596, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	15.1	172
Cockpit and Fuel Gage Lights - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C15.1	172B
Carburetor Mixture, Oil, and Free Air Temperature Indicators - Airplanes AF49-2897 Through AF49-3226	17.1	174
Carburetor Mixture, Oil, and Free Air Temperature Indicators - Airplanes AF49-3227 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	17.01	174B
Carburetor Mixture, Oil, and Free Air Temperature Indicators - Airplanes AF49-3538 Through AF49-3596	17.01A	174D
Carburetor Mixture, Oil, and Free Air Temperature Indicators - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C17.1	174F
Marker Beacon - Airplanes AF49-2897 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	19.1	176
Marker Beacon - Airplanes AF49-3538 Through AF49-3596	19.2	176B

TITLE	DIAGRAM IDENTIFICATION	PAGE
Marker Beacon - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C19.1	176D
Instrument Landing System - Airplanes AF49-2897 Through AF49-2981	21.1	178
Instrument Landing System - Airplanes AF49-2982 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	21.2	178B
AN/ARN-7 Radio Compass Control - Airplanes AF49-2897 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	23.1	180
VHF and Interphone - Airplanes AF49-2897 Through AF49-2981 (Sheet 1 of 2 Sheets)	25.1-1	182
VHF and Interphone - Airplanes AF49-2897 Through AF49-2981 (Sheet 2 of 2 Sheets)	25.1-2	184
VHF and Interphone - Airplanes AF49-2982 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	25.2-1	184B
VHF and Interphone - Airplanes AF49-2982 Through AF49-3044, AF49-3087 Through AF49-3537, AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077	25.2-2	184D
VHF and Interphone - Airplanes AF49-3045 Through AF49-3086	25.2-3	184F
AN/ARC-3 Radio - Airplanes AF49-3538 Through AF49-3596	24.1	186
AN/ARC-3 Radio - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent (Sheet 1 of 2 Sheets)	C24.1-1	186B
AN/ARC-3 Radio - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent (Sheet 2 of 2 Sheets)	C24.1-2	186D
AN/ARN-6 Radio - Airplanes AF49-3538 Through AF49-3596	24.2	188
AN/ARN-6 Radio Compass - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent	C24.2	188B
Interphone System - Airplanes AF49-3538 Through AF49-3596	24.3	190
Interphone System - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent (Sheet 1 of 2 Sheets)	C24.3-1	190B
Interphone System - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent (Sheet 2 of 2 Sheets)	C24.3-2	190D
SCR-522 Radio - Airplanes AF49-3538 Through AF49-3596	24.4	192A
SCR-522-A Radio - Airplanes AF51-14350 Through AF51-14683	24.5	193
Gun Sight and Camera - Airplanes AF49-3538 Through AF49-3596	27.1	194
Armament - Airplanes AF49-3188 Through AF49-3596 and AF50-1277 Through AF50-1326 (Sheet 1 of 3 Sheets)	27.2-1	196
Armament - Airplanes AF49-3188 Through AF49-3596 and AF50-1277 Through AF50-1326 (Sheet 2 of 3 Sheets)	27.2-2	198
Armament - Airplanes AF49-3188 Through AF49-3596 and AF50-1277 Through AF50-1326 (Sheet 3 of 3 Sheets)	27.2-3	198B

8-4. DIAGRAM REFERENCE IDENTIFICATION CODE.

8-5. Each electrical and electronic schematic diagram has been assigned a reference identification code, which appears in the lower right-hand corner. This identification code also appears in the wiring diagram index, paragraph 8-3. Where a portion of a circuit extends from one diagram to another, the reference identification code of the diagram in which the continuation of the circuit may be found is shown at the reference point. For example, the identification code "25.1-2," the "25" indicates that the diagram is one of the VHF and Interphone group, "1" allows for future additions to this group, and "2" shows that it is sheet 2 of 2 sheets.

8-6. ELECTRICAL AND ELECTRONIC WIRING IDENTIFICATION.

8-7. To facilitate wiring installation, each wire is identified by a letter-number combination stamped on the wire at 6- to 18-inch intervals throughout its entire length. For cable identification, see figure 8-2, sheet 1 of 4 sheets. Following is the identification code for wiring used in T-6G Airplanes. This code does not apply to internal wiring of equipment.

D. DE-ICING OR ANTI-ICING CIRCUITS.

E. ENGINE INSTRUMENT CIRCUITS.

F. FLIGHT INSTRUMENT CIRCUITS.

G. LANDING GEAR CIRCUITS.

J. IGNITION CIRCUITS.

K. ENGINE CONTROL CIRCUITS.

L. LIGHTING CIRCUITS.

N. GROUND NETWORK WIRING.

Any wire that completes the circuit to the ground network from an equipment item is designated with the letter "N."

In explanation, it may be said that any wire with an "N" circuit function letter could be connected to the airplane ground network without malfunctioning of the circuit.

NR - Ground, Radio Navigational and Communication Equipment

P. POWER.

All wiring of battery, generator, voltage regulator, field supply, rectifier output, generator load equalizer resistor, and their controls, etc, has the "P" classification. All d-c power wiring for more than one circuit is identified by the letter "P," with no additional circuit designation letter. This includes feeders from reverse-current relays to busses, from batteries to busses, etc.

Q. FUEL AND OIL.

R. RADIO NAVIGATIONAL AND COMMUNICATION EQUIPMENT.

RA - Instrument Landing Equipment
RM - Marker Beacon
RN - Radio Navigation
RV - VHF Command
RZ - Interphone

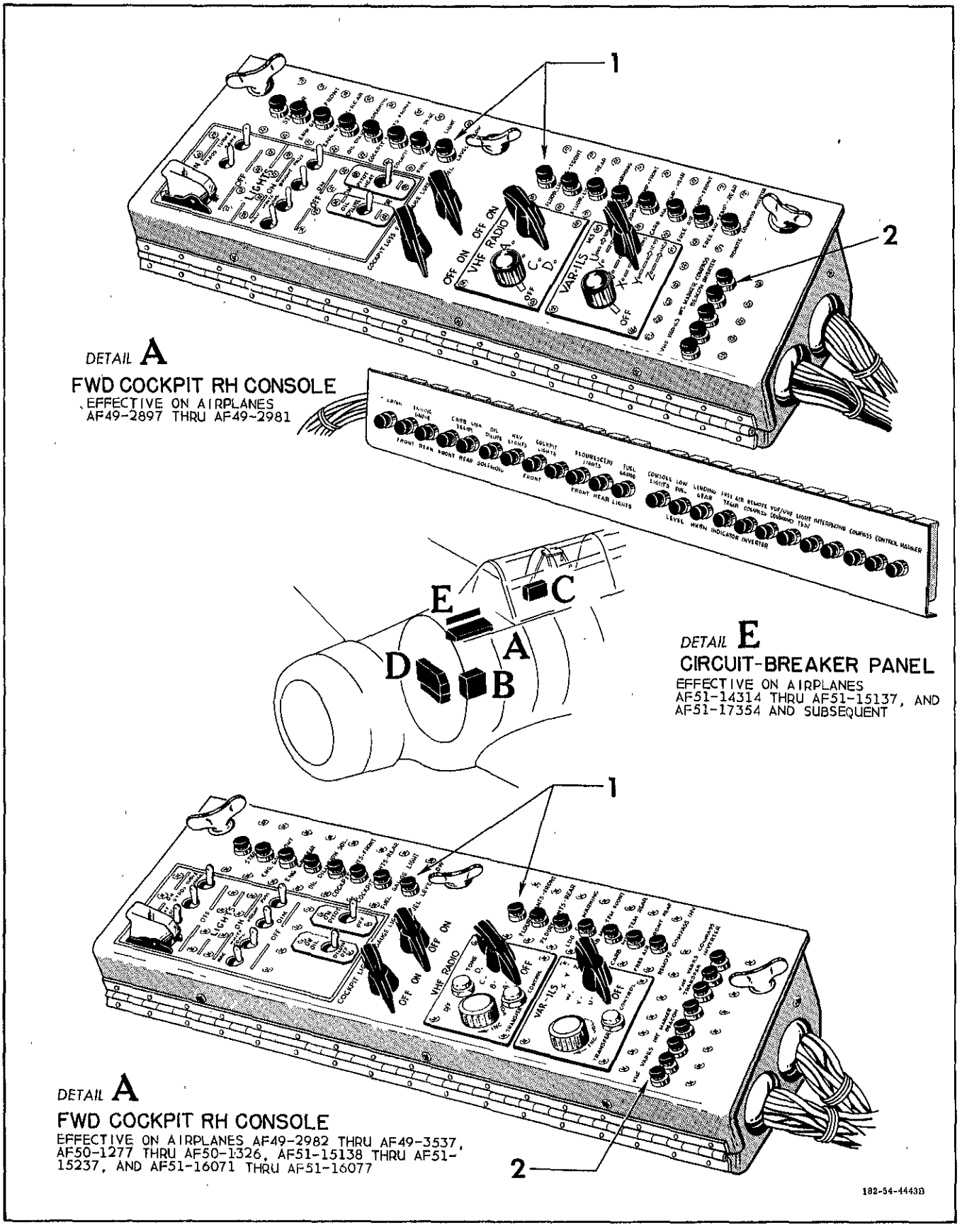
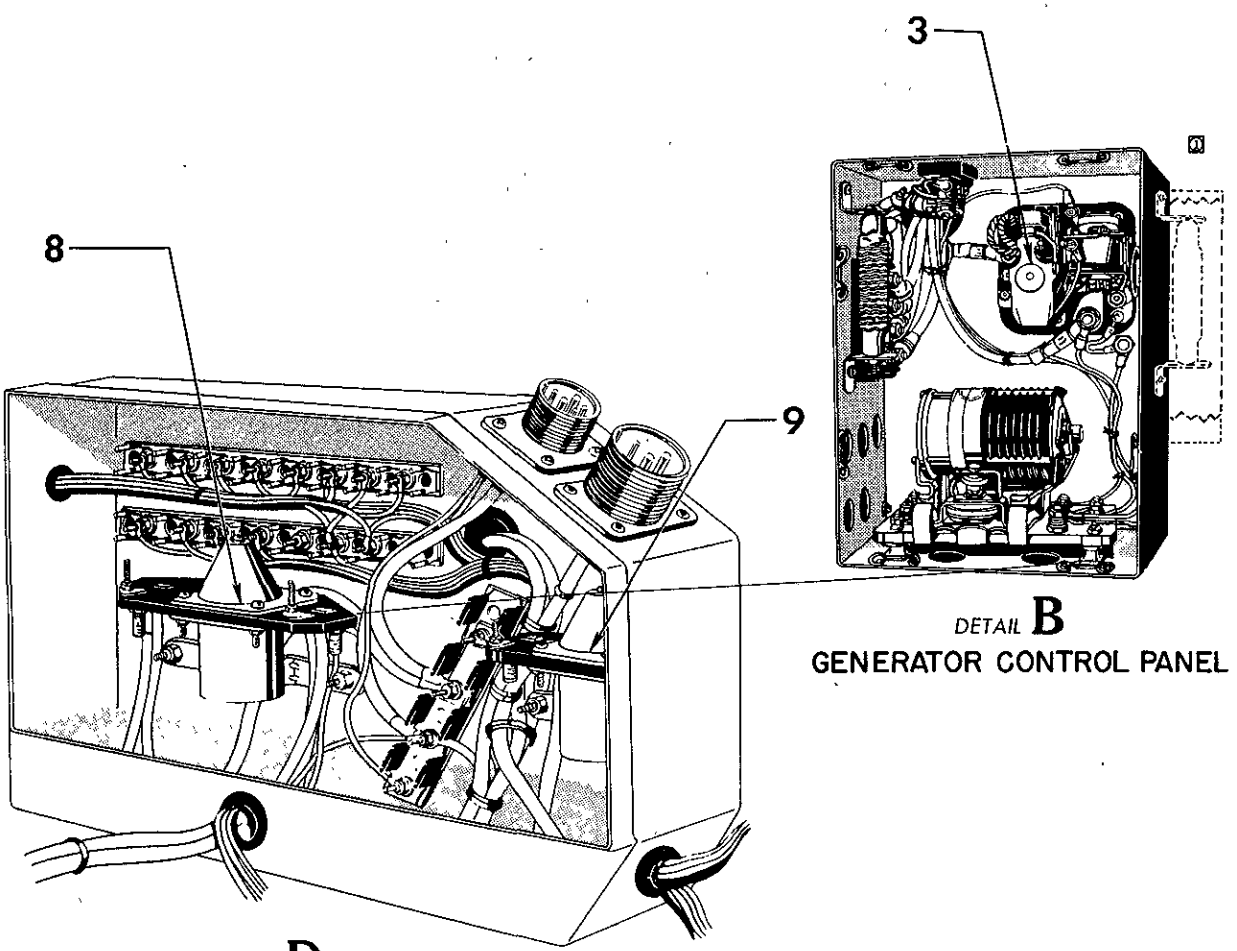


Figure 8-1 (Sheet 1 of 4 Sheets). Circuit Breaker and Relay Location Chart

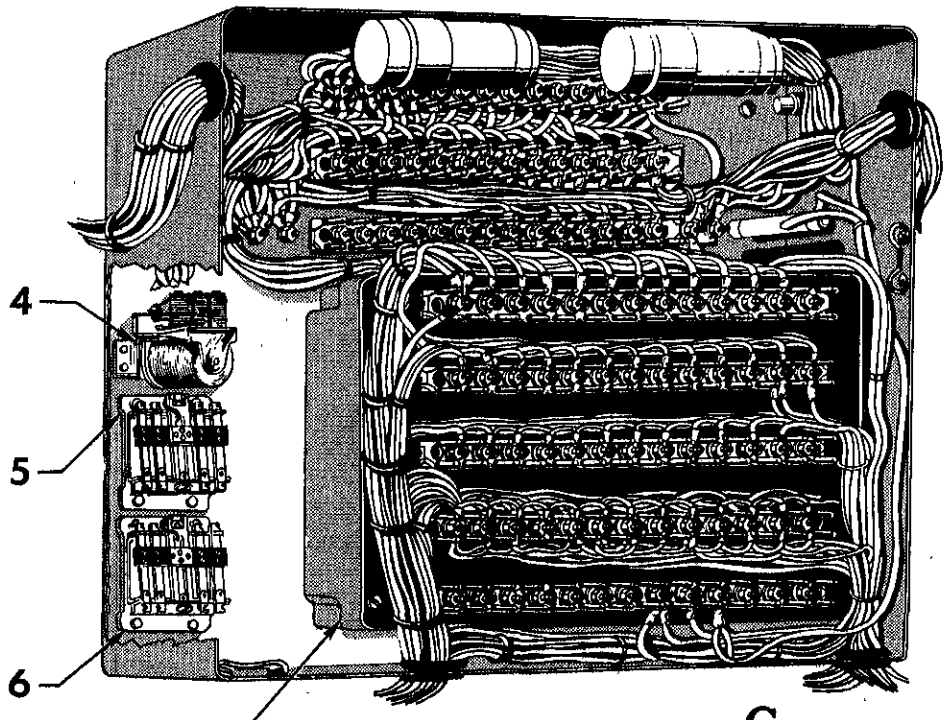


[1] THE CURRENT LIMITING RESISTOR IS RELOCATED TO THE EXTERIOR OF THE GENERATOR CONTROL PANEL AIRPLANES AF51-14401 THRU AF51-15137, AND AF51-17354 AND SUBSEQUENT.

1 ELECTRICAL CIRCUIT BREAKERS
2 ELECTRONIC CIRCUIT BREAKERS
3 GENERATOR CONTROL RELAY
4 INTERPHONE SWITCHING RELAY
5 VAR-ILS TRANSFER RELAY (AIRPLANES AF49-2982 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16077)
6 VHF TRANSFER RELAY (AIRPLANES AF49-2897 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16077)
7 RADIO COMPASS RELAY
8 STARTER RELAY
9 BATTERY-DISCONNECT RELAY
10 AM-142/A1C MIXER AMPLIFIER (AIRPLANES AF51-14314 THRU AF51-15137, AND AF51-17354 AND SUBSEQUENT)
11 VHF TRANSFER RELAY (AIRPLANES AF51-14314 THRU AF51-15137, AND AF51-17354 AND SUBSEQUENT)
12 INTERPHONE TRANSFER RELAY (AIRPLANES AF51-14314 THRU AF51-15137, AND AF51-17354 AND SUBSEQUENT)

182-54-4444B

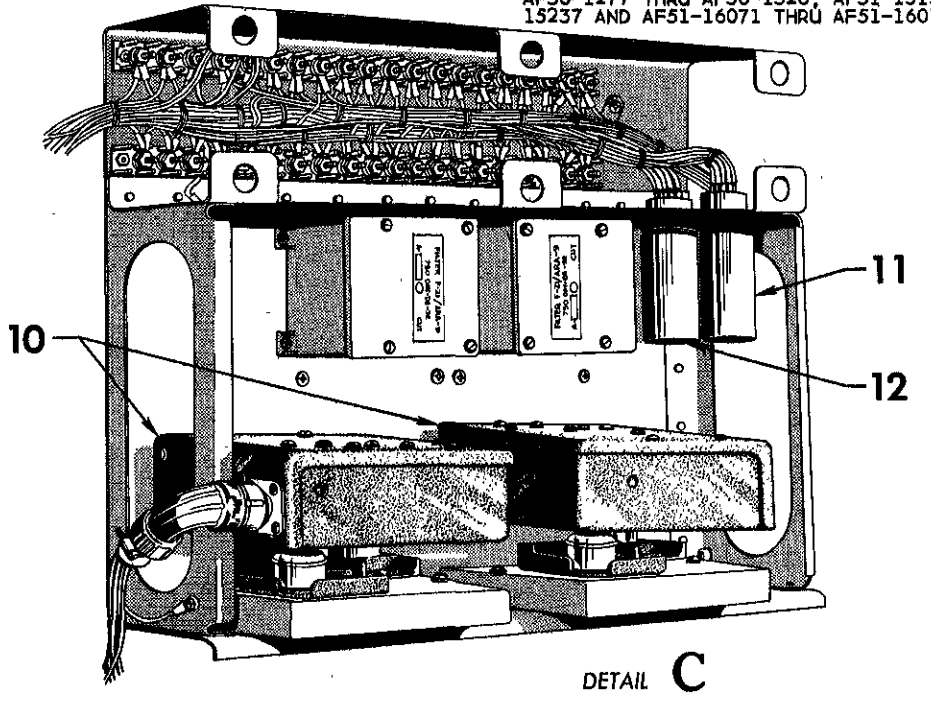
Figure 8-1 (Sheet 2 of 4 Sheets). Circuit Breaker and Relay Location Chart



DETAIL C

RADIO JUNCTION BOX

EFFECTIVE ON AIRPLANES AF49-2897 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237 AND AF51-16071 THRU AF51-16077



DETAIL C

RADIO JUNCTION BOX

EFFECTIVE ON AIRPLANES AF51-14314 THRU AF51-15137, AND AF51-17354 AND SUBSEQUENT

182-54-4445B

Figure 8-1 (Sheet 3 of 4 Sheets). Circuit Breaker and Relay Location Chart

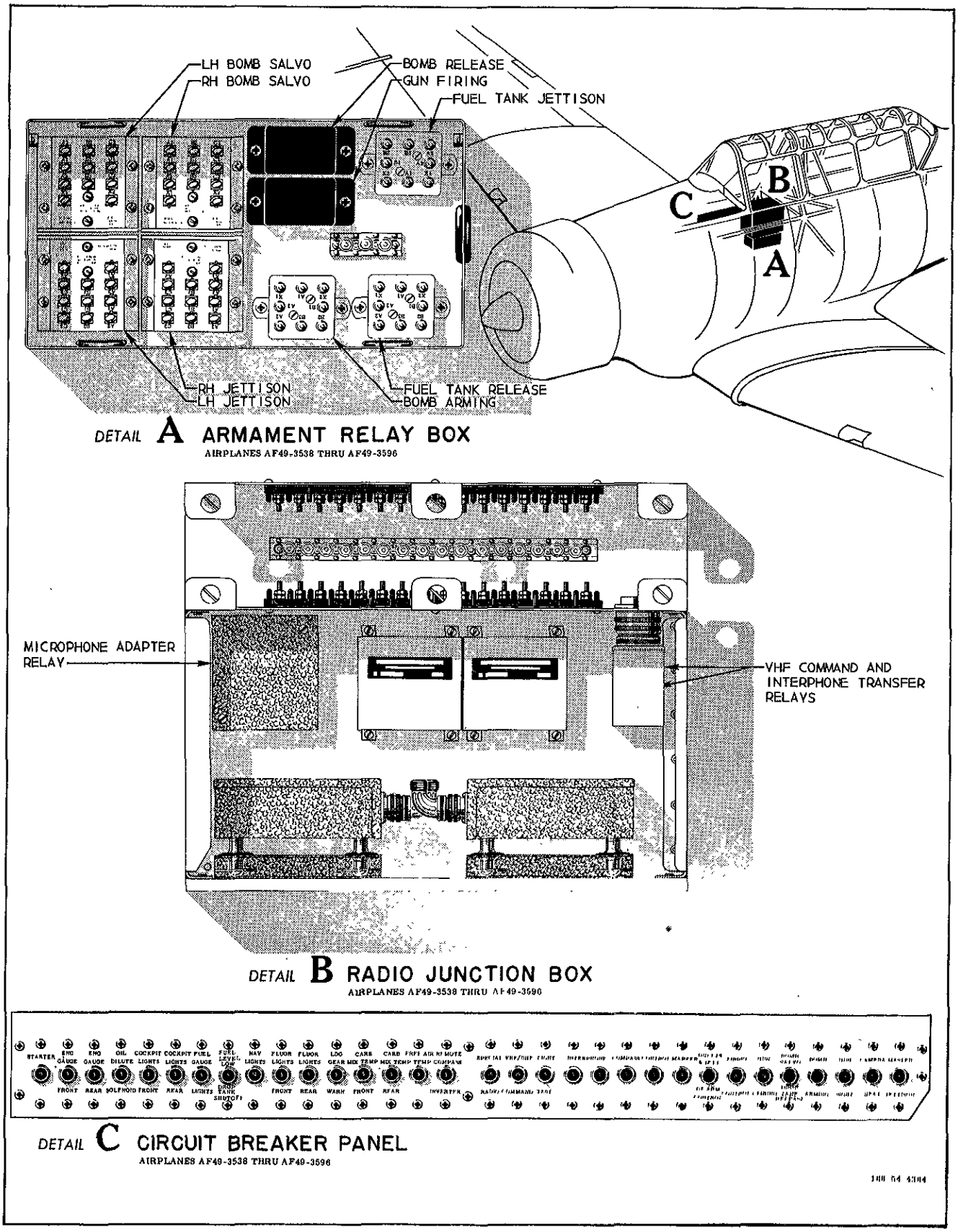


Figure 8-1 (Sheet 4 of 4 Sheets). Circuit Breaker and Relay Location Chart

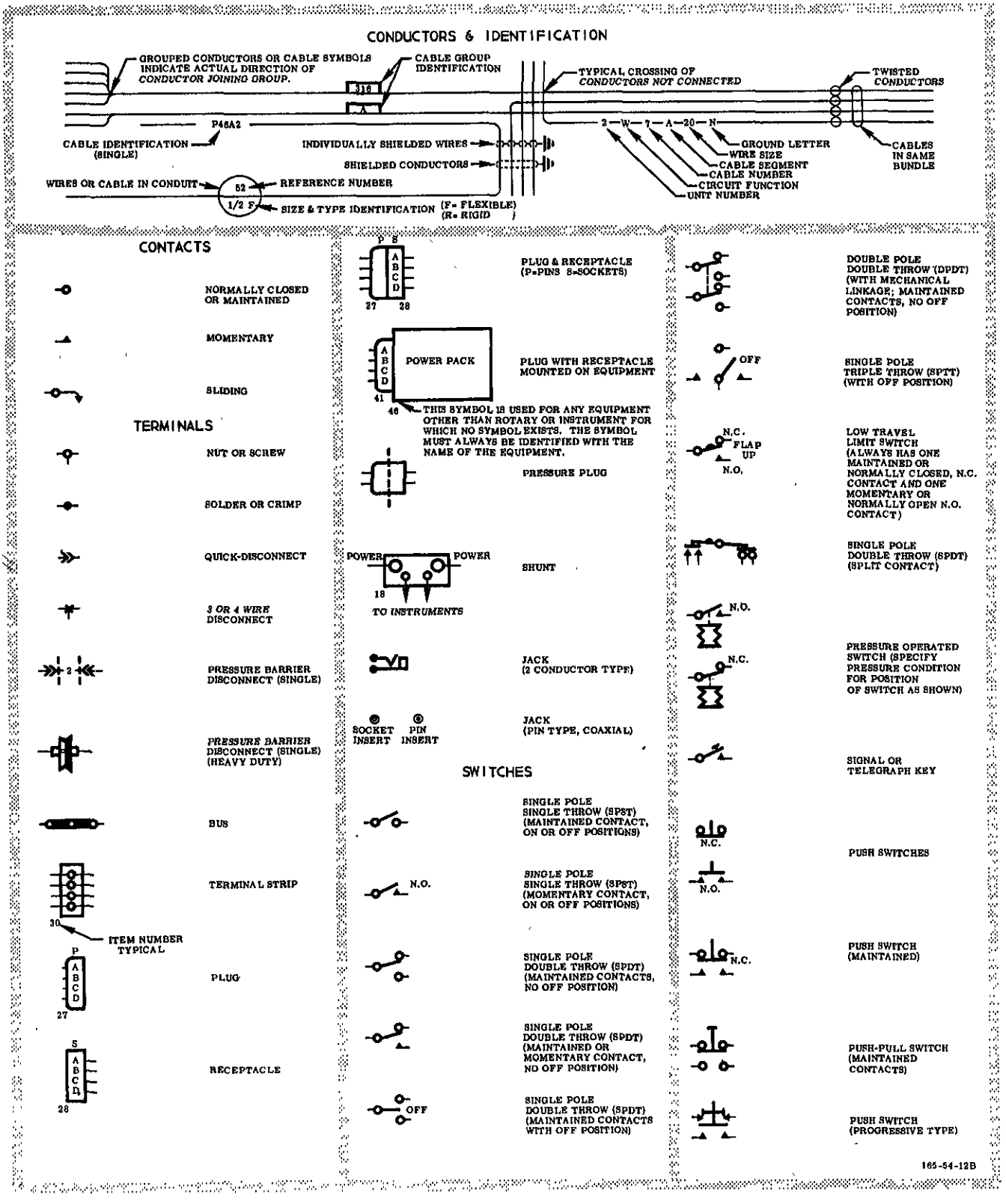


Figure 8-2 (Sheet 1 of 4 Sheets). Electrical Symbol Chart

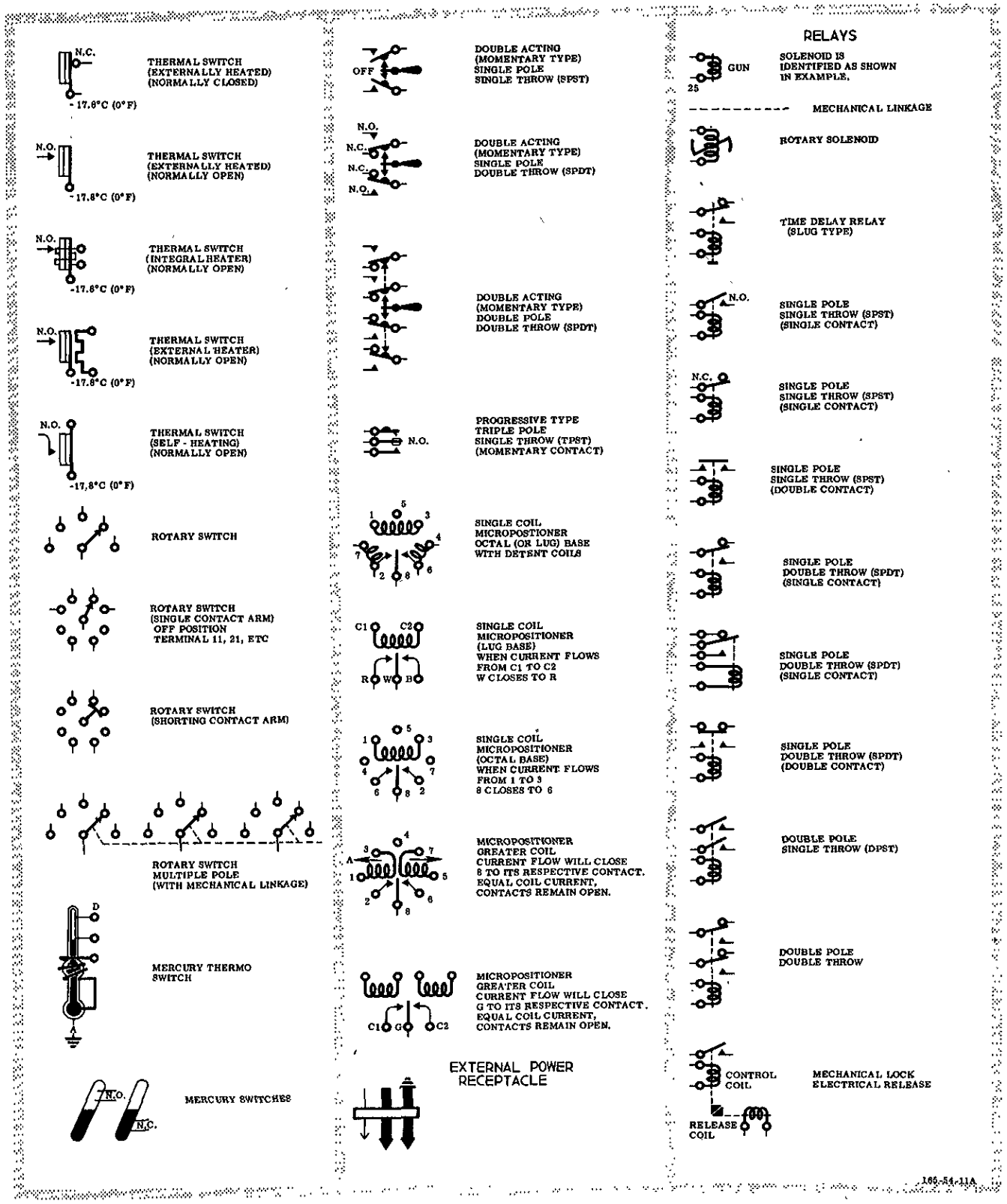


Figure 8-2 (Sheet 2 of 4 Sheets). Electrical Symbol Chart

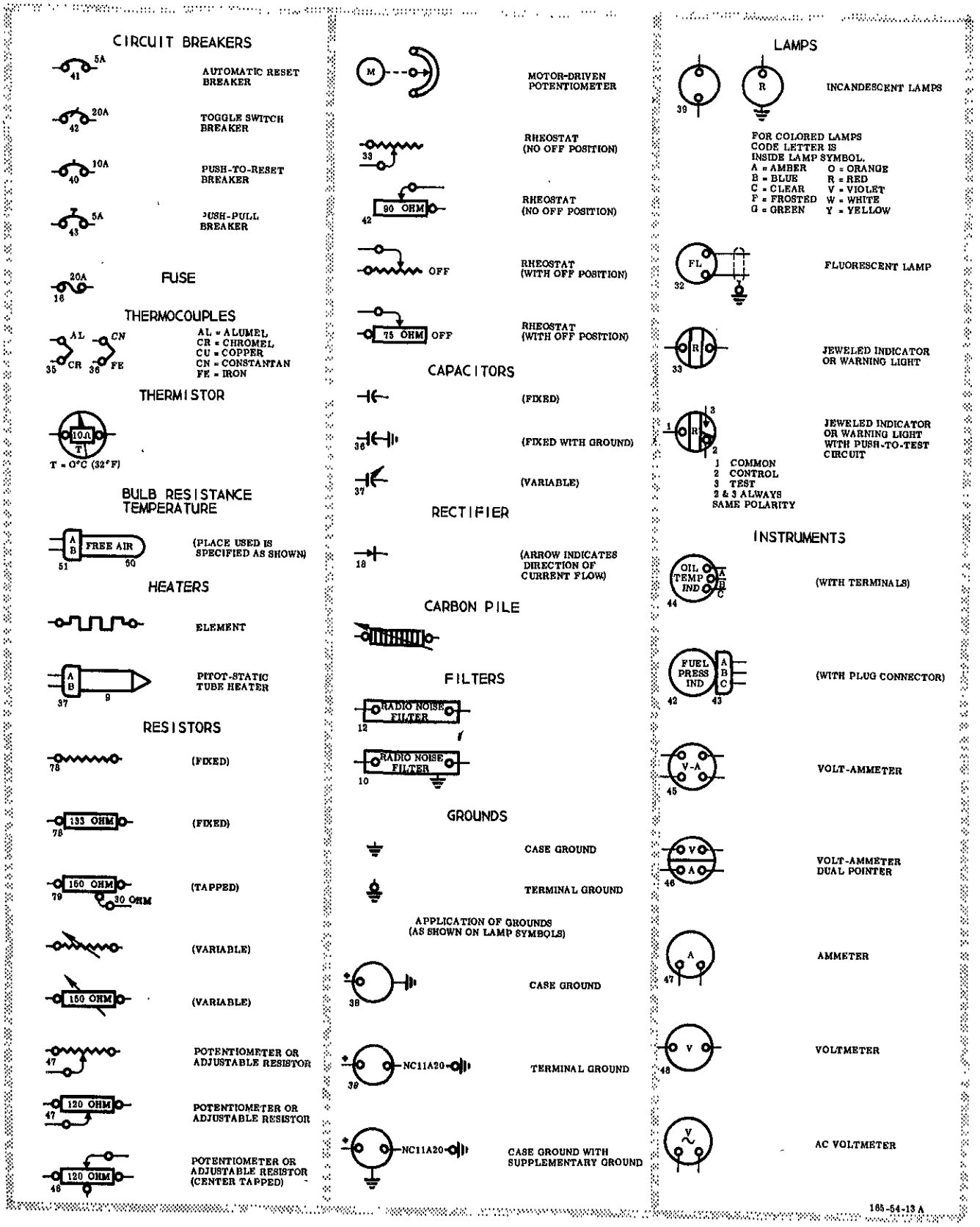


Figure 8-2 (Sheet 3 of 4 Sheets). Electrical Symbol Chart

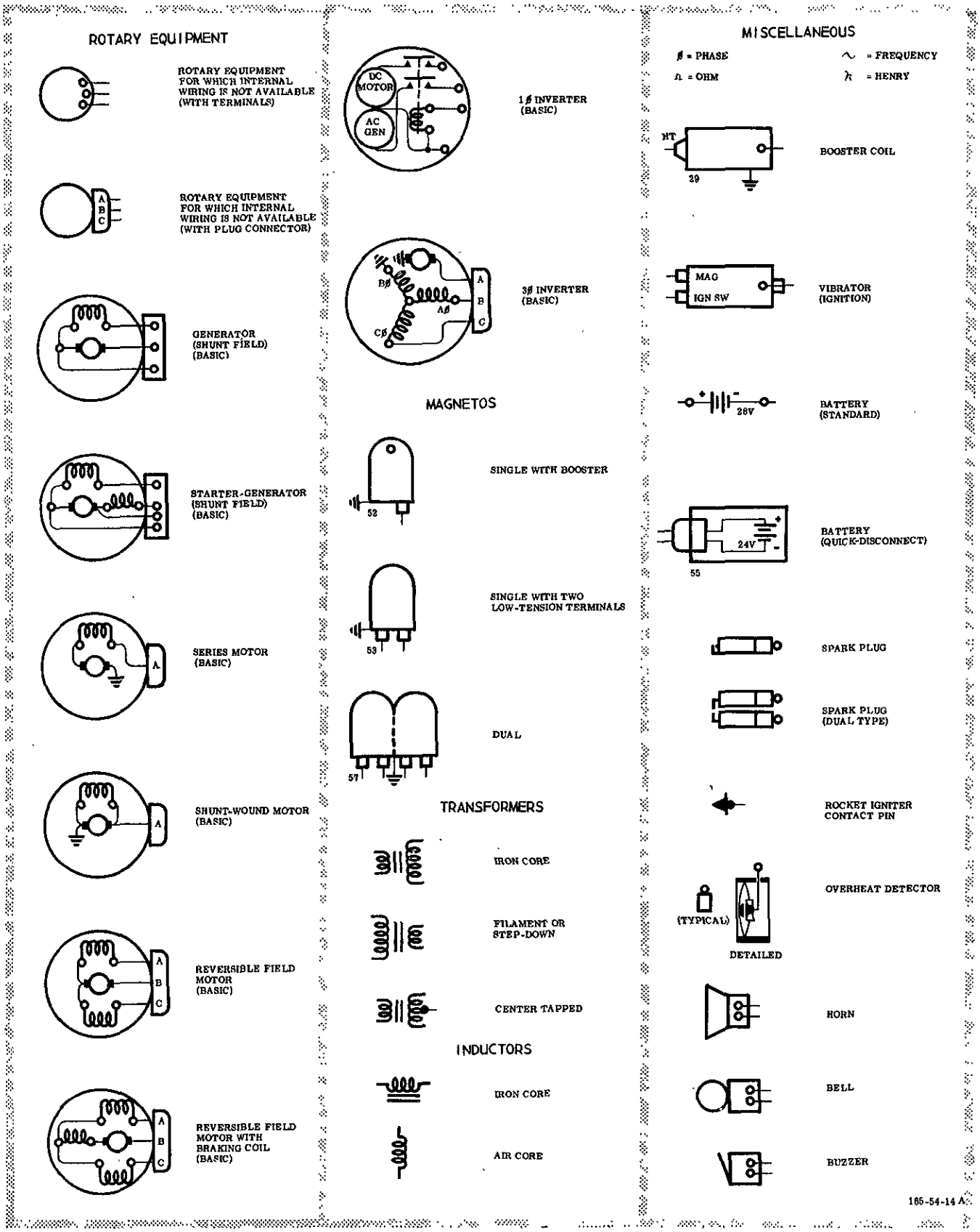
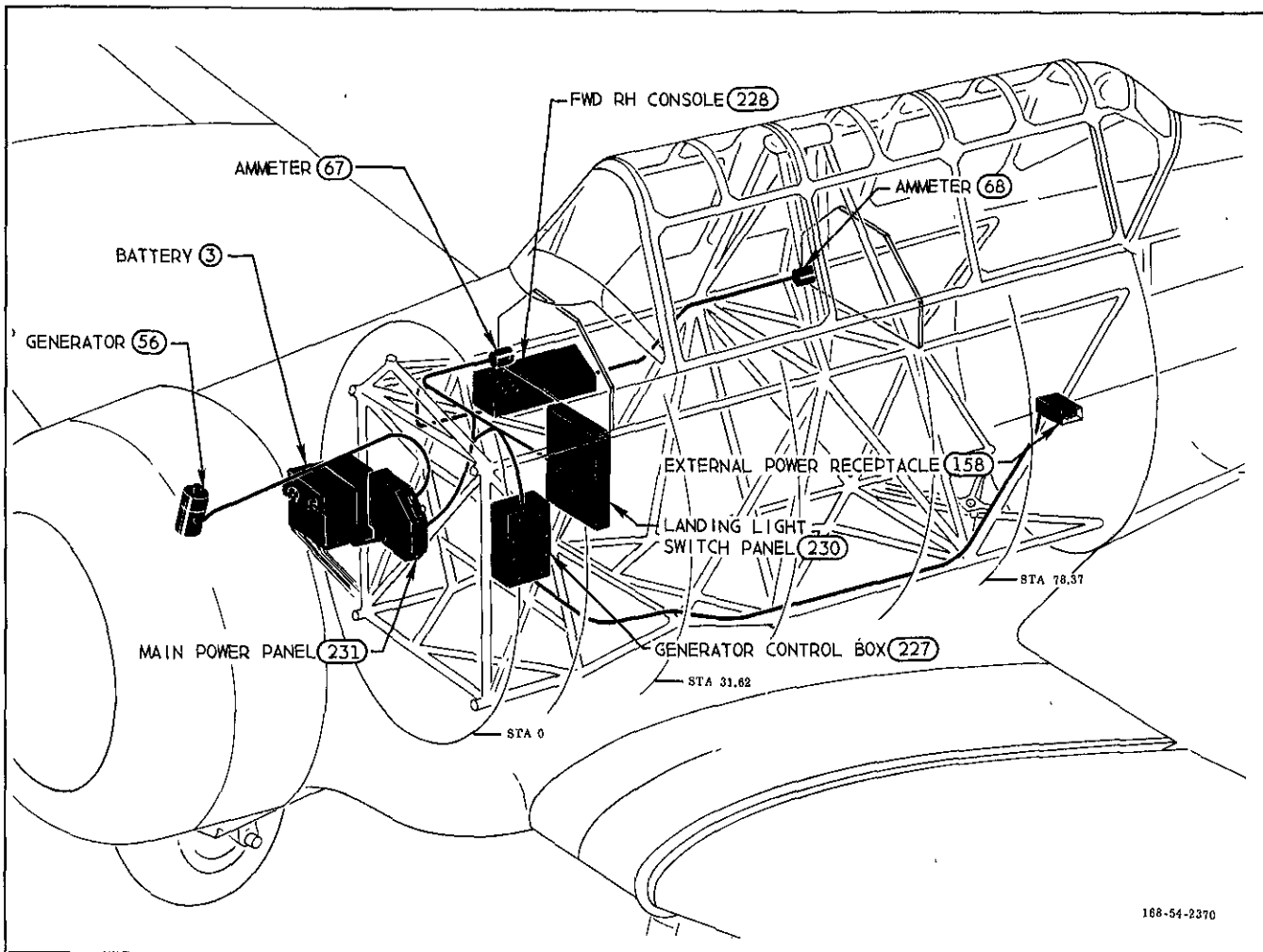


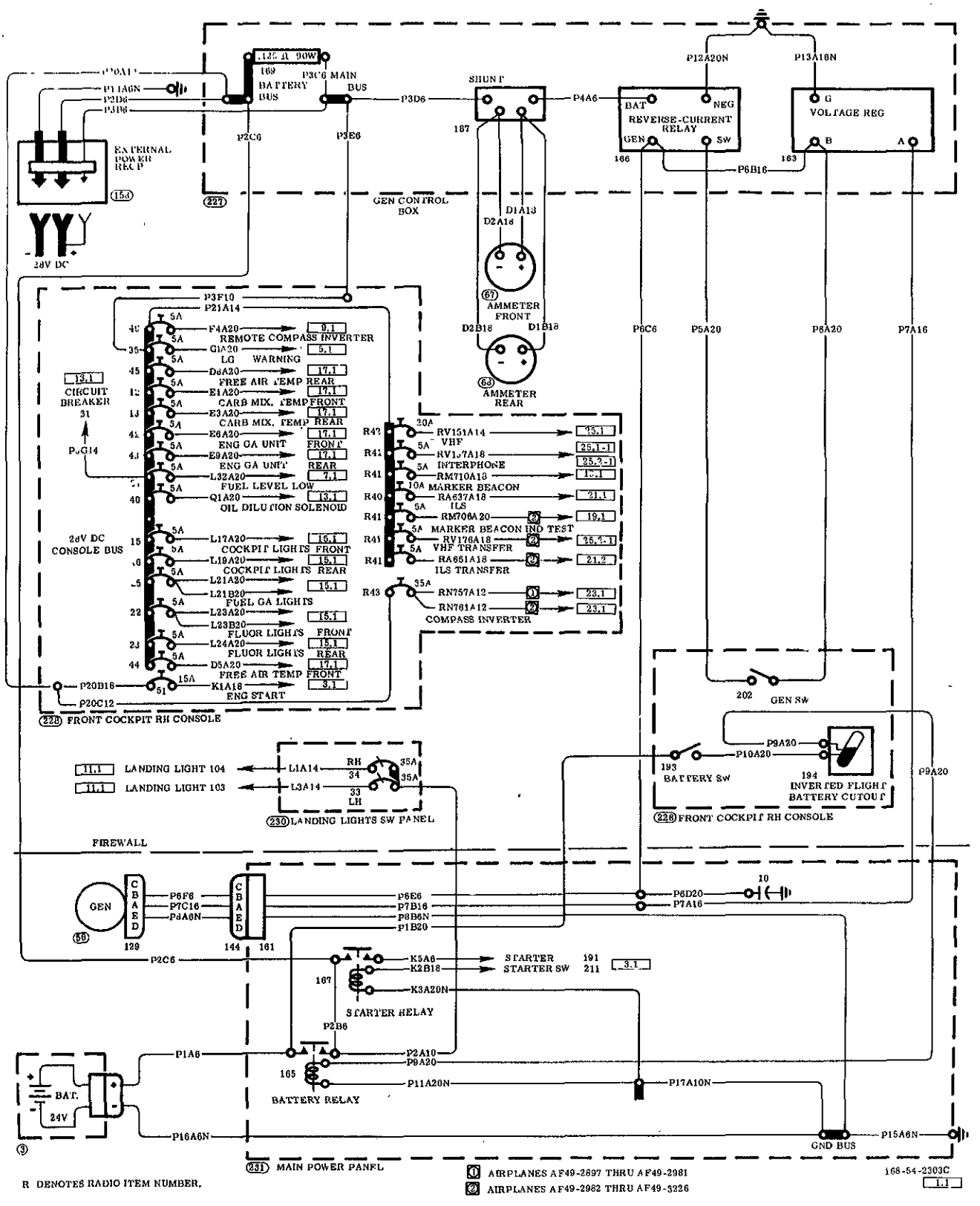
Figure 8-2 (Sheet 4 of 4 Sheets). Electrical Symbol Chart



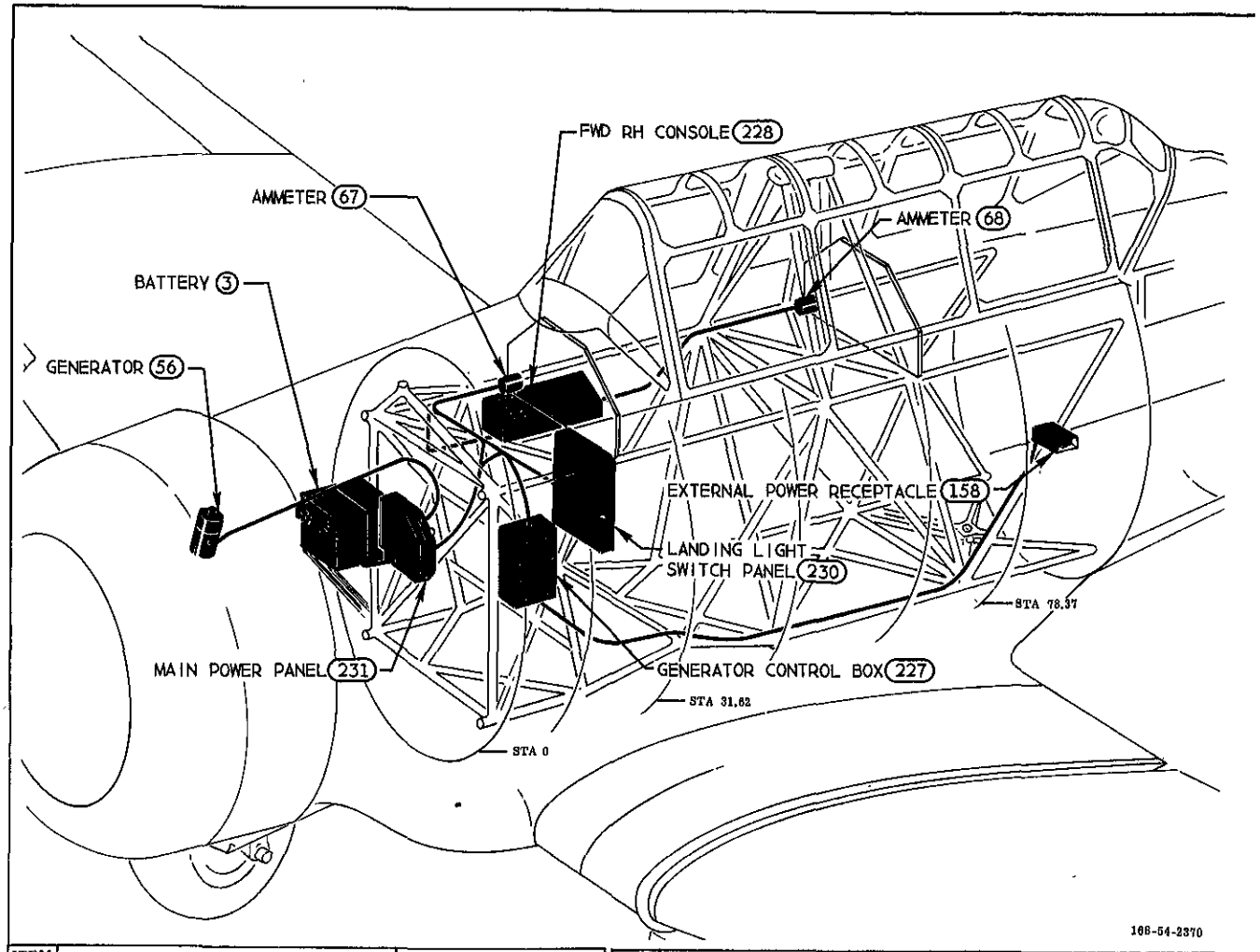
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
3	Battery	AN3150-A
10	*Capacitor - Generator*	*CA-275X (Girard Hopkins)*
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
15	Circuit Breaker - Cockpit Lights (Front)	AN3161-P5
16	Circuit Breaker - Cockpit Lights (Rear)	AN3161-P5
22	Circuit Breaker - Fluorescent Lights (Front Cockpit)	AN3161-P5
23	Circuit Breaker - Fluorescent Lights (Rear Cockpit)	AN3161-P5
25	Circuit Breaker - Fuel Gage Lights	AN3161-P5
27	Circuit Breaker - Fuel Low Level Warning Light	AN3161-P5
33	*Circuit Breaker - Landing Light (Left-hand)*	AN3160-35
34	Circuit Breaker - Landing Light (Right-hand)	AN3160-35
35	Circuit Breaker - Landing Gear Warning	AN3161-P5
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
*40	Circuit Breaker - 10-amp	AN3161-P10
*41	Circuit Breaker - 5-amp	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
*42	Circuit Breaker - 20-amp	AN3161-P20
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
*43	Circuit Breaker - 35-amp	AN3161-P35
44	Circuit Breaker - Free Air Temperature (Front Cockpit)	AN3161-P5
45	Circuit Breaker - Free Air Temperature (Rear Cockpit)	AN3161-P5
49	Circuit Breaker - Remote Compass Inverter	AN3161-P5
	* Radio Item Number	

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
51	Circuit Breaker - Starter	AN3161-P15
56	*Generator* - 50-amp 28-volt Electrical Type M-3	95-32361
67	Indicator - Type F-1 Ammeter (Front Cockpit)	94-32284
68	Indicator - Type F-1 Ammeter (Rear Cockpit)	*94-32284*
103	Light Assembly - 450-watt PAR-56 Left-hand Landing	4541 (General Electric)
104	Light Assembly - 450-watt PAR-56 Right-hand Landing	4541 (General Electric)
129	Plug - Generator	AN3106-22-12S
144	Plug - Power Panel Generator Disconnect	AN3106-22-12S
158	Receptacle - External Power	AN2552-A1
161	Receptacle - Generator Power Panel Disconnect	AN3102-22-12P
163	Regulator - Voltage Type B-1	94-32276
165	Relay - Battery Type B-4	94-32324
166	Relay - Reverse-current	AN3025-1
167	Relay - Starter Type B-8	94-32424
169	*Resistor - Battery Charging, 125-ohm 90-watt*	COABE (Ohmite)
187	Shunt - 150-amp Ammeter	94-32284
191	Starter - G-5	95-32303
193	Switch - Battery	AN3022-2
194	Switch - Battery Inverter Flight Cutout	AS445B-2 (Minneapolis-Honeywell)
202	Switch - Generator	AN3022-2
211	Switch - Starter	AN3023-7
227	Control Box - Generator	168-54068 (NAA)
228	Console - Forward Right-hand	168-54005 (NAA)
230	Box Assembly - Alighting Gear Position Indicators	168-33523 (NAA)
231	Panel - Main Power	168-54072 (NAA)

Figure 8-3. D-C Power Control and Distribution -



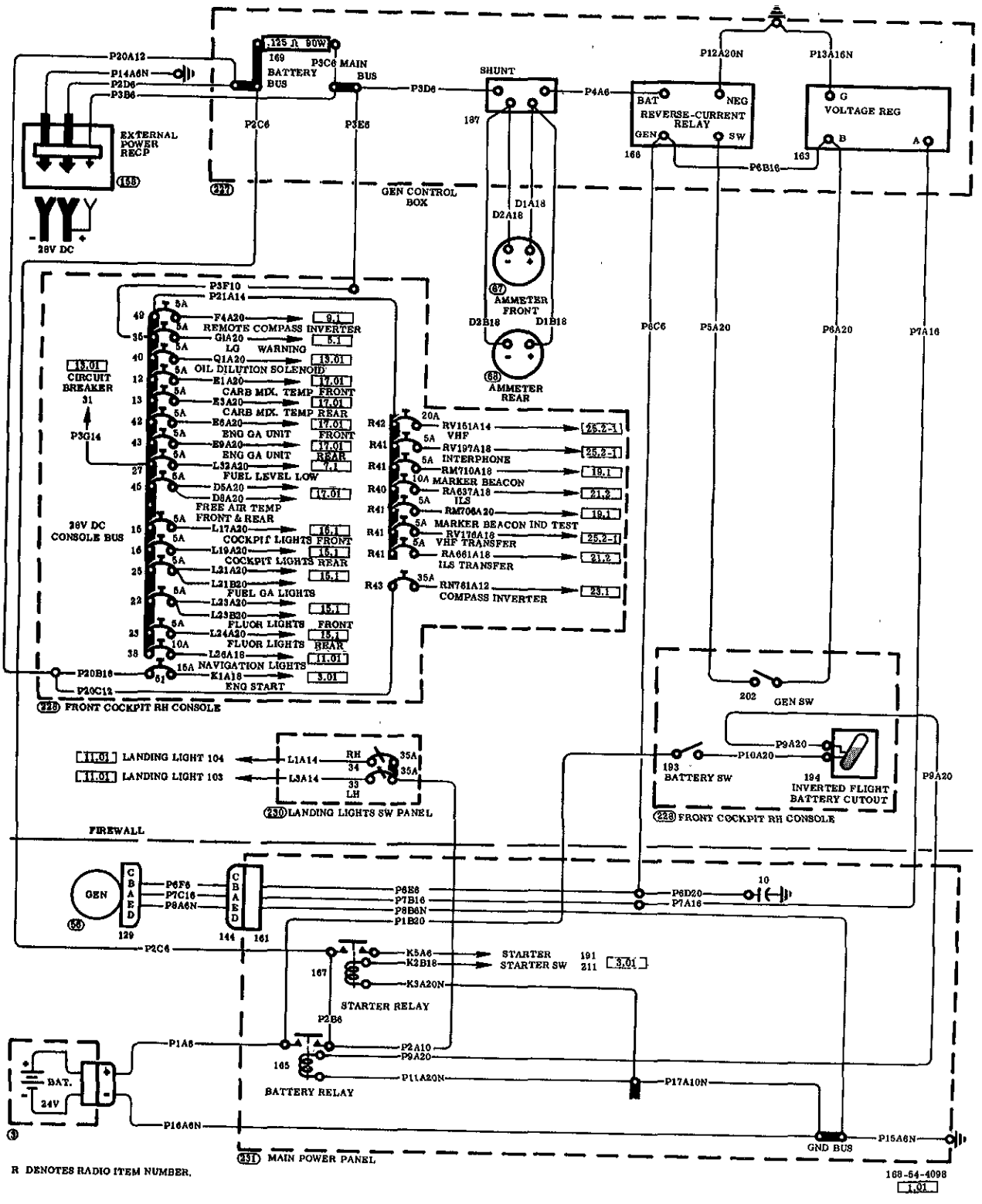
Airplanes AF49-2897 Through AF49-3226

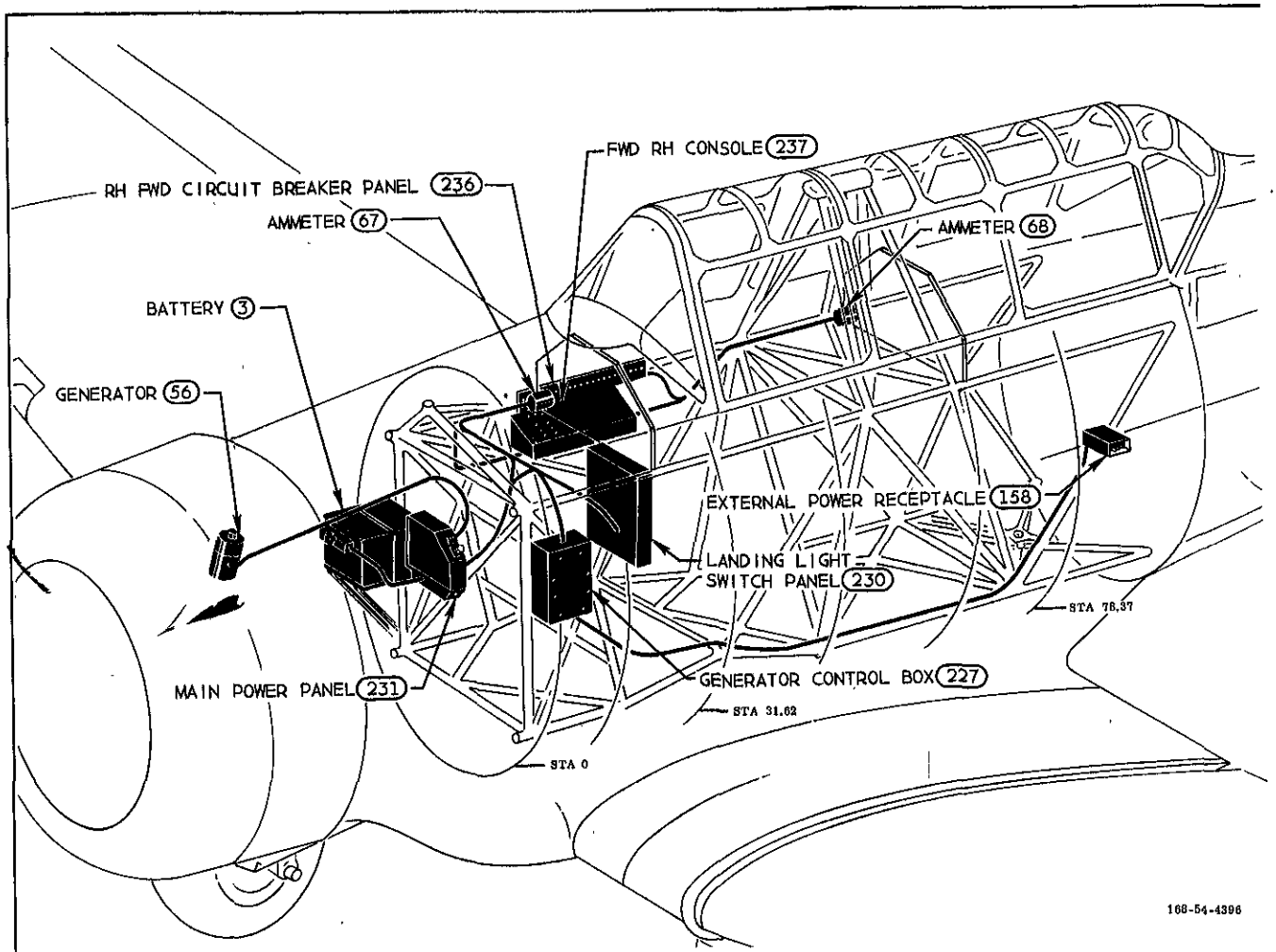


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
3	Battery	AN3150-A
10	Capacitor - Generator	CA-275X (Girard Hopkins)
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
15	Circuit Breaker - Cockpit Lights (Front)	AN3161-P5
16	Circuit Breaker - Cockpit Lights (Rear)	AN3161-P5
22	Circuit Breaker - Fluorescent Lights (Front Cockpit)	AN3161-P5
23	Circuit Breaker - Fluorescent Lights (Rear Cockpit)	AN3161-P5
25	Circuit Breaker - Fuel Gage Lights	AN3161-P5
27	Circuit Breaker - Fuel Low Level Warning Light	AN3161-P5
33	Circuit Breaker - Landing Light (Left-hand)	AN3160-35
34	Circuit Breaker - Landing Light (Right-hand)	AN3160-35
35	Circuit Breaker - Landing Gear Warning	AN3161-P5
38	Circuit Breaker - Navigation	AN3160-10
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
*40	Circuit Breaker - 10-amp	AN3161-P10
*41	Circuit Breaker - 5-amp	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
*42	Circuit Breaker - 20-amp	AN3161-P20
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
*43	Circuit Breaker - 35-amp	AN3161-P35
45	Circuit Breaker - Free Air Temperature (Front and Rear Cockpit)	AN3161-P5
49	Circuit Breaker - Remote Compass Inverter	AN3161-P5
51	Circuit Breaker - Starter	AN3161-P15
	* Radio Item Number	

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
56	Generator - 50-amp 28-volt Electrical Type M-3	95-32361
67	Indicator - Type F-1 Ammeter (Front Cockpit)	94-32284
68	Indicator - Type F-1 Ammeter (Rear Cockpit)	94-32284
103	Light Assembly - 450-watt Par-56 Left-hand Landing	4541 (General Electric)
104	Light Assembly - 450-watt Par-56 Right-hand Landing	4541 (General Electric)
111	Switch - Starter	AN3022-7
129	Plug - Generator	AN3106-22-12S
144	Plug - Power Panel Generator Disconnect	AN3106-22-12S
158	Receptacle - External Power	AN2552-A1
161	Receptacle - Generator Power Panel Disconnect	AN3102-22-12P
163	Regulator - Voltage Type B-1	94-32276
165	Relay - Battery Type B-4	94-32324
166	Relay - Reverse-current	AN3025-1
167	Relay - Starter Type B-8	94-32424
169	Resistor - Battery Charging .125-ohm 90-watt	COABE (Ohmite)
187	Shunt - 150-amp Ammeter	94-32284
191	Starter - G-5	96-32303
193	Switch - Battery	AN3022-2
194	Switch - Battery Inverter Flight Cutout	AS445B-2 (Minneapolis-Honeywell)
202	Switch - Generator	AN3022-2
211	Switch - Starter	AN3023-7
227	Control Box - Generator	168-54068 (NAA)
228	Console - Forward Right-hand	168-54005-20 (NAA)
230	Box Assembly - Alighting Gear Position Indicators	168-33523 (NAA)
231	Panel - Main Power	168-54072 (NAA)

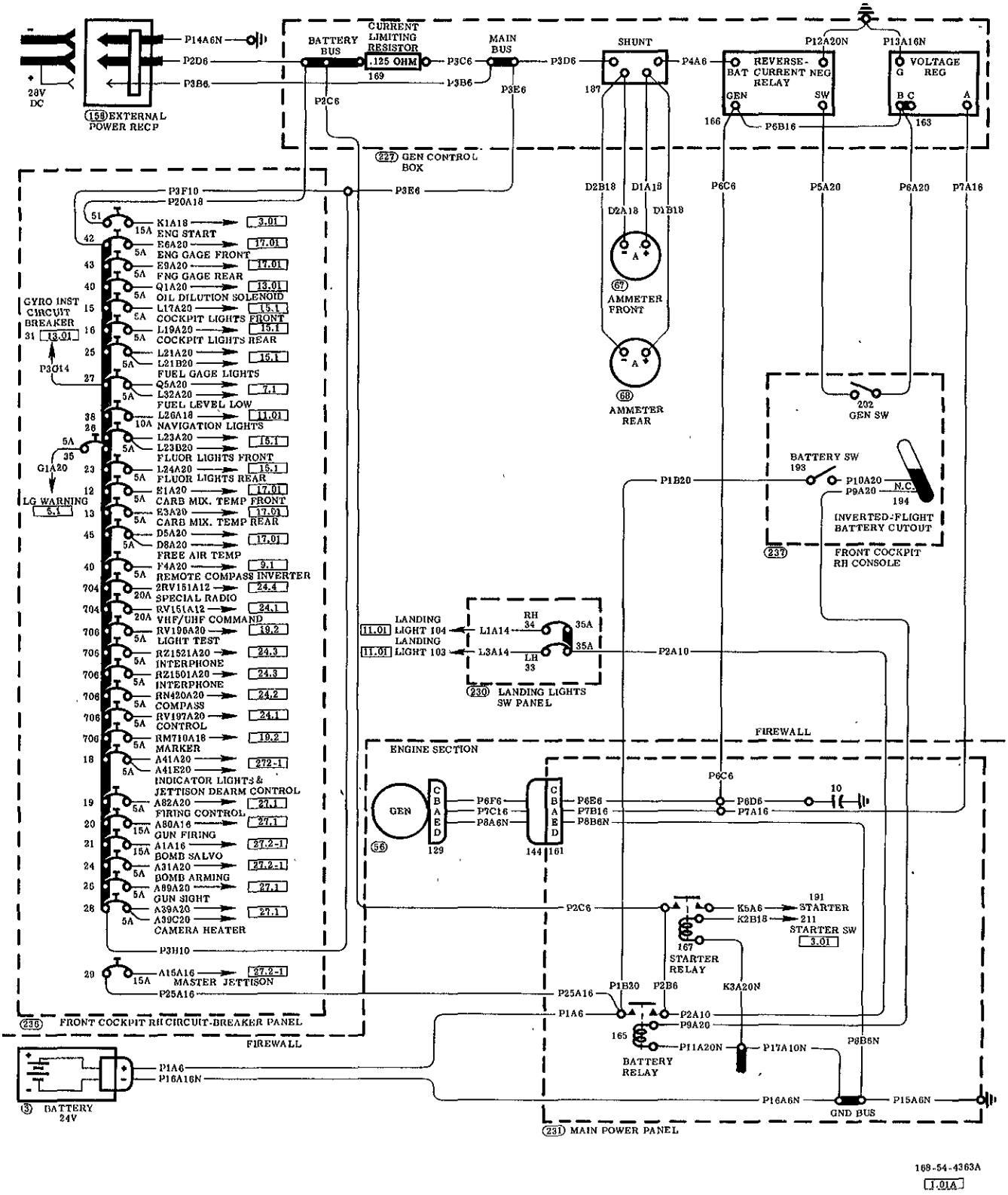
Figure 8-3A. D-C Power Control and Distribution - Airplanes AF49-3227 Through AF49-3537

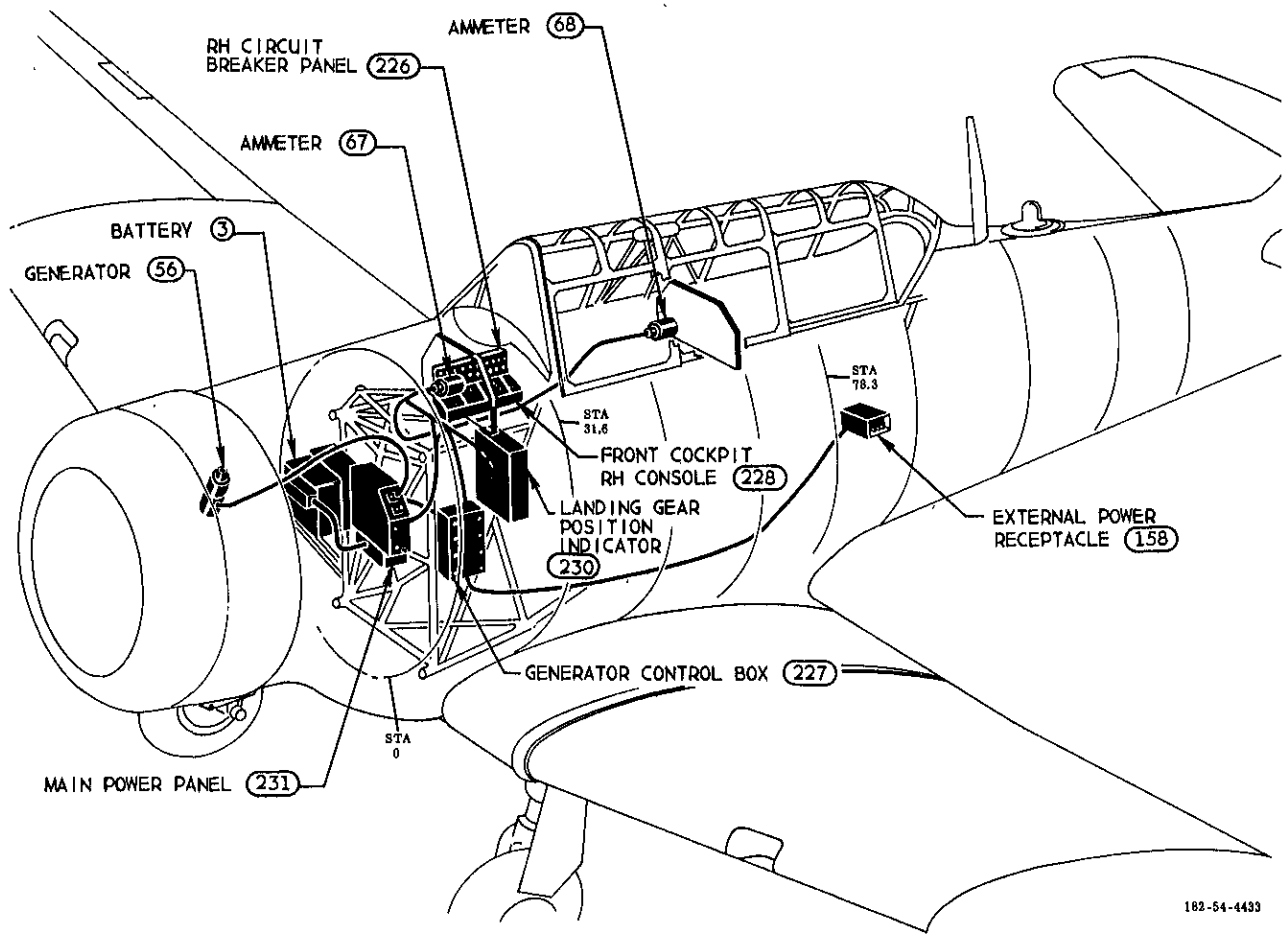

.125 Ω 90W
169
P3C6 MAIN BATTERY BUS
BUS
P20A12
P14A6N
P2D6
P3B6
P3D6
P4A6
SHUNT
187
P12A20N
P13A16N
BAT
NEG
REVERSE-CURRENT RELAY
GEN
SW
166
G
VOLTAGE REG
B
A
163
P6B16
EXTERNAL POWER RECP
155
P2C6
P3E6
227
GEN CONTROL BOX
D1A18
D2A18
67
AMMETER FRONT
D2B18
D1B18
68
AMMETER REAR
28V DC
P6C6
P5A20
P6A20
P7A16
P3F10
P21A14
CIRCUIT BREAKER 31
P3G14
F4A20 REMOTE COMPASS INVERTER
G1A20 LG WARNING
Q1A20 OIL DILUTION SOLENOID
E1A20 CARB MIX. TEMP FRONT
E3A20 CARB MIX. TEMP REAR
E6A20 ENG GA UNIT FRONT
E9A20 ENG GA UNIT REAR
L32A20 FUEL LEVEL LOW
D5A20
D6A20 FREE AIR TEMP FRONT & REAR
28V DC CONSOLE BUS
L17A20 COCKPIT LIGHTS FRONT
L19A20 COCKPIT LIGHTS REAR
L21A20
L21B20 FUEL GA LIGHTS
L23A20
L23B20 FLUOR LIGHTS FRONT
L24A20 FLUOR LIGHTS REAR
L26A18
K1A18 ENG START
NAVIGATION LIGHTS
P20B18
P20C12
228 FRONT COCKPIT RH CONSOLE
RV151A14 VHF
RV197A18 INTERPHONE
RM710A18 MARKER BEACON
RA637A18 ILS
RM706A20 MARKER BEACON IND TEST
RV176A18 VHF TRANSFER
RA661A18 ILS TRANSFER
RN761A12 COMPASS INVERTER
202 GEN SW
P9A20
P10A20
193 BATTERY SW
194 INVERTED FLIGHT BATTERY CUTOUT
L1A14 LANDING LIGHT 104
L3A14 LANDING LIGHT 103
RH
LH
230 LANDING LIGHTS SW PANEL
FIREWALL
GEN
C B A E D
129
144
161
P6F6
P7C16
P8A6N
P6E8
P7B16
P8B6N
P1B20
P6D20
P7A16
10
P2C6
K5A6
K2B16
STARTER SW
191
211
STARTER
K3A20N
STARTER RELAY
167
P2B6
P1A6
P2A10
P9A20
P11A20N
P17A10N
BAT.
24V
165
BATTERY RELAY
P16A6N
GND BUS
P15A6N
251 MAIN POWER PANEL
R DENOTES RADIO ITEM NUMBER.
168-64-4098



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
3	Battery	AN3150-A
10	Capacitor - Generator	CA-275X (Girard Hopkins)
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
15	Circuit Breaker - Cockpit Lights (Front Cockpit)	AN3161-P5
16	Circuit Breaker - Cockpit Lights (Rear Cockpit)	AN3161-P5
18	Circuit Breaker - Indicator Lights and Jettison Dearming Control	AN3161-P5
19	Circuit Breaker - Firing Controls	AN3161-P5
20	Circuit Breaker - Gun Firing	AN3161-P15
21	Circuit Breaker - Bomb Salvo	AN3161-P15
23	Circuit Breaker - Fluorescent Lights (Rear Cockpit)	AN3161-P5
24	Circuit Breaker - Bomb Arming	AN3161-P5
25	Circuit Breaker - Fuel Gage Light	AN3161-P5
26	Circuit Breaker - Gun Sight	AN3161-P5
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
28	Circuit Breaker - Camera Heater	AN3161-P5
29	Circuit Breaker - Master Jettison	AN3161-P15
35	Circuit Breaker - Landing Gear Warning	AN3161-P5
38	Circuit Breaker - Navigation Light	AN3161-P10
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
46	Circuit Breaker - Free Air Temperature (Rear Cockpit)	AN3161-P5
49	Circuit Breaker - Remote Compass Inverter	AN3161-P5
51	Circuit Breaker - Starter	AN3161-P15
56	Generator - Electrical 50-amp 28-volt	M-3 95-32361
67	Indicator - Ammeter (Front Cockpit)	F-1 94-32284
68	Indicator - Ammeter (Rear Cockpit)	F-1 94-32284
129	Plug - Generator	AN3106-22-12S
144	Plug - Power Panel Generator Disconnect	AN3106-22-12S
158	Receptacle - External Power	AN2552-N
161	Receptacle - Generator Power Panel Disconnect	AN3102-22-12P
163	Regulator - Voltage	B-1 94-32276
165	Relay - Battery	B-4 94-32324
166	Relay - Reverse Current	AN3026-1
167	Relay - Starter	B-8 94-32424
169	Resistor - Battery Charging .125-ohm 90-watt	ACYOU (Ohmite)
187	Shunt - Ammeter 150-amp	94-32284
193	Switch - Battery	AN3022-2
194	Switch - Battery Inverter Flight Cutout	AS445B-2 M-H
202	Switch - Generator	AN3022-2
227	Control Box - Generator	168-54068 (NAA)
230	Box Assembly - Landing Gear Position Indicators	168-33523 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)
236	Panel - Right-hand Forward Circuit Breaker	168-54082 (NAA)
704	Circuit Breaker	AN3161-P20
706	Circuit Breaker	AN3161-P5

Figure 8-3B. D-C Power Control and Distribution -

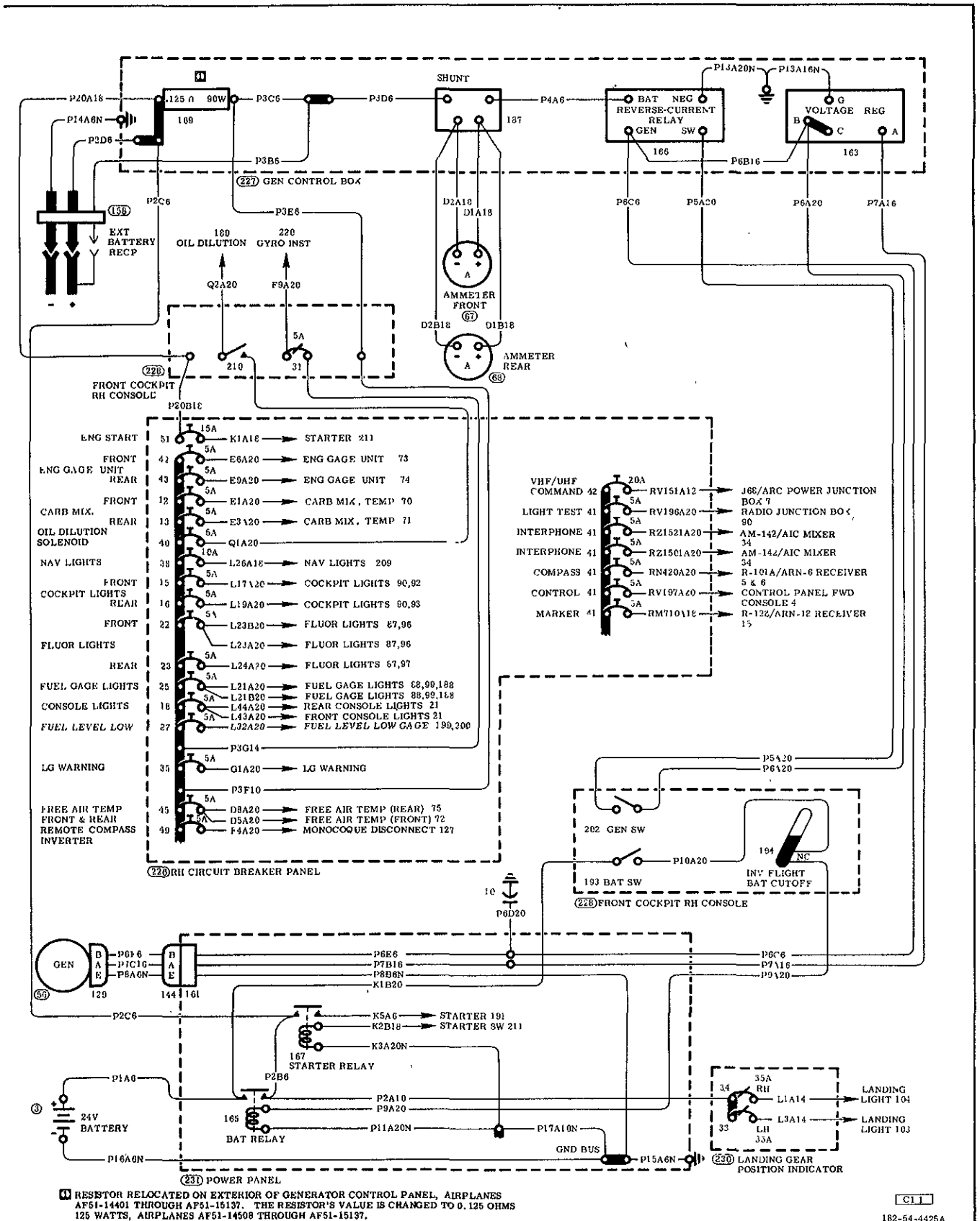

28V DC
P14A6N
P2D6
P3B6
(159) EXTERNAL POWER RECP
BATTERY BUS
CURRENT LIMITING RESISTOR .125 OHM
169
P3C6
MAIN BUS
P3D6
P3B6
P3E6
P2C6
SHUNT
187
P4A6
REVERSE-CURRENT RELAY
BAT
NEG
GEN
SW
P12A20N
P13A16N
VOLTAGE REG
G
B C
A
166
P6B16
163
(227) GEN CONTROL BOX
D2B18
D1A18
D2A18
D1B18
(67) AMMETER FRONT
(68) AMMETER REAR
P6C6
P5A20
P6A20
P7A16
202 GEN SW
BATTERY SW
193
P10A20
P9A20
N.C.
194
INVERTED-FLIGHT BATTERY CUTOUT
(237) FRONT COCKPIT RH CONSOLE
P1B20
P3F10
P20A18
GYRO INST CIRCUIT BREAKER
31
13.01
P3O14
G1A20
LG WARNING
5.1
K1A18 ENG START 3.01
E6A20 ENG GAGE FRONT 17.01
E9A20 ENG GAGE REAR 17.01
Q1A20 OIL DILUTION SOLENOID 13.01
L17A20 COCKPIT LIGHTS FRONT 15.1
L19A20 COCKPIT LIGHTS REAR 15.1
L21A20 L21B20 FUEL GAGE LIGHTS 15.1
Q5A20 L32A20 FUEL LEVEL LOW 7.1
L26A18 NAVIGATION LIGHTS 11.01
L23A20 L23B20 FLUOR LIGHTS FRONT 15.1
L24A20 FLUOR LIGHTS REAR 15.1
E1A20 CARB MIX. TEMP FRONT 17.01
E3A20 CARB MIX. TEMP REAR 17.01
D5A20 D8A20 FREE AIR TEMP 17.01
F4A20 REMOTE COMPASS INVERTER 9.1
2RV151A12 SPECIAL RADIO 24.4
RV151A12 VHF/UHF COMMAND 24.1
RV196A20 LIGHT TEST 19.2
RZ1521A20 INTERPHONE 24.3
RZ1501A20 INTERPHONE 24.3
RN420A20 COMPASS 24.2
RV197A20 CONTROL 24.1
RMT10A18 MARKER 19.2
A41A20 A41E20 INDICATOR LIGHTS & JETTISON DEARM CONTROL 27.1
A82A20 FIRING CONTROL 27.1
A80A16 GUN FIRING 27.1
A1A16 BOMB SALVO 27.2-1
A31A20 BOMB ARMING 27.2-1
A99A20 GUN SIGHT 27.1
A39A20 A39C20 CAMERA HEATER 27.1
A15A16 MASTER JETTISON 27.2-1
P3H10
P25A16
(236) FRONT COCKPIT RH CIRCUIT-BREAKER PANEL
LANDING LIGHT 104 11.01
LANDING LIGHT 103 11.01
L1A14
L3A14
RH 34
LH 33
35A
(230) LANDING LIGHTS SW PANEL
FIREWALL
ENGINE SECTION
GEN
(56)
C B A E D
129
P6F6
P7C16
P8A6N
144 161
P6E6
P7B16
P8B6N
P6C6
P6D6
P7A16
10
P2C6
K5A6
K2B18
191 STARTER
211 STARTER SW 3.01
167 STARTER RELAY
P1B20
P2B6
K3A20N
P25A16
P1A6
P2A10
P9A20
165
P11A20N
P17A10N
BATTERY RELAY
P8B6N
P16A6N
P15A6N
GND BUS
(231) MAIN POWER PANEL
(3) BATTERY 24V
P1A6
P16A16N
168-54-4363A
1.01A



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
3	Battery	AN3150-A (GFP)
10	Capacitor - Generator	CA-275X (Girard-Hopkins)
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
15	Circuit Breaker - Cockpit Lights (Front)	AN3161-P5
16	Circuit Breaker - Cockpit Lights (Rear)	AN3161-P5
18	Circuit Breaker - Console Lights	AN3161-P5
22	Circuit Breaker - Fluorescent Lights (Front Cockpit)	AN3161-P5
23	Circuit Breaker - Fluorescent Lights (Rear Cockpit)	AN3161-P5
25	Circuit Breaker - Fuel Gage Lights	AN3161-P5
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-5
33	Circuit Breaker - Landing Light (Left-hand)	AN3160-35
34	Circuit Breaker - Landing Light (Right-hand)	AN3160-35
35	Circuit Breaker - Landing Gear Warning	AN3161-P5
38	Circuit Breaker - Navigation Light	AN3161-P10
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
*41	Circuit Breaker - 5-amp	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
45	Circuit Breaker - Free Air Temperature (Front and Rear)	AN3161-P5
	* Radio Item Number	

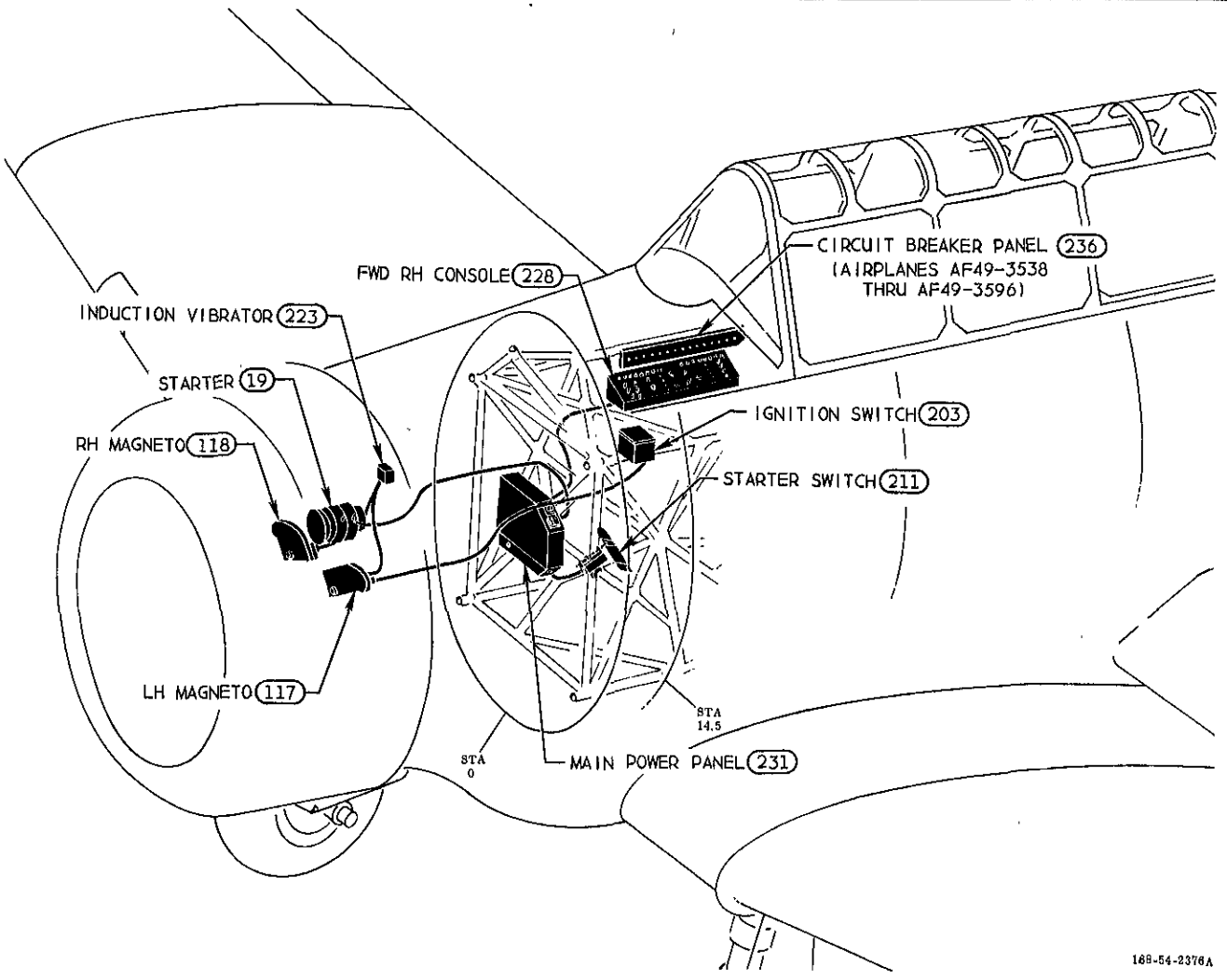
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
49	Circuit Breaker - Remote Compass Inverter	AN3161-P5
51	Circuit Breaker - Starter	AN3161-P5
56	Generator - 50-ampere, 28-volt Electrical	Type M-3 (GFP)
67	Indicator - Ammeter (Front Cockpit)	94-32284, Type F-1 (GFP)
68	Indicator - Ammeter (Rear Cockpit)	94-32284, Type F-1 (GFP)
129	Plug - Generator	AN3106-22-12S
144	Plug - Power Panel Generator Disconnect	AN3106-22-12S
158	Receptacle - External Power	AN2552-A1
161	Receptacle - Generator Power Panel Disconnect	AN3102-22-12P
163	Regulator - Voltage	94-32276, Type B-1 (GFP)
165	Relay - Battery	94-32324, Type B-4 (GFP)
166	Relay - Reverse-current	AN3025-1
167	Relay - Starter	94-32424, Type B-8 (GFP)
169	Resistor - Battery Charging	COABE (Ohmite)
187	Shunt - 150-amp Ammeter	94-32284 (GFP)
193	Switch - Battery	AN3022-2
194	Switch - Battery Inverter Flight Cutout	AS445B-2 (Minneapolis-Honeywell)
202	Switch - Generator	AN3022-2
210	Switch - Oil Dilution Solenoid	AN3022-8
226	Panel - Circuit Breaker	182-54027 (NAA)
227	Control Box - Generator	168-54068 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
230	Box Assembly - Landing Gear Position Indicator	168-33523 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)

Figure 8-3C. D-C Power Control and Distribution - Airplanes



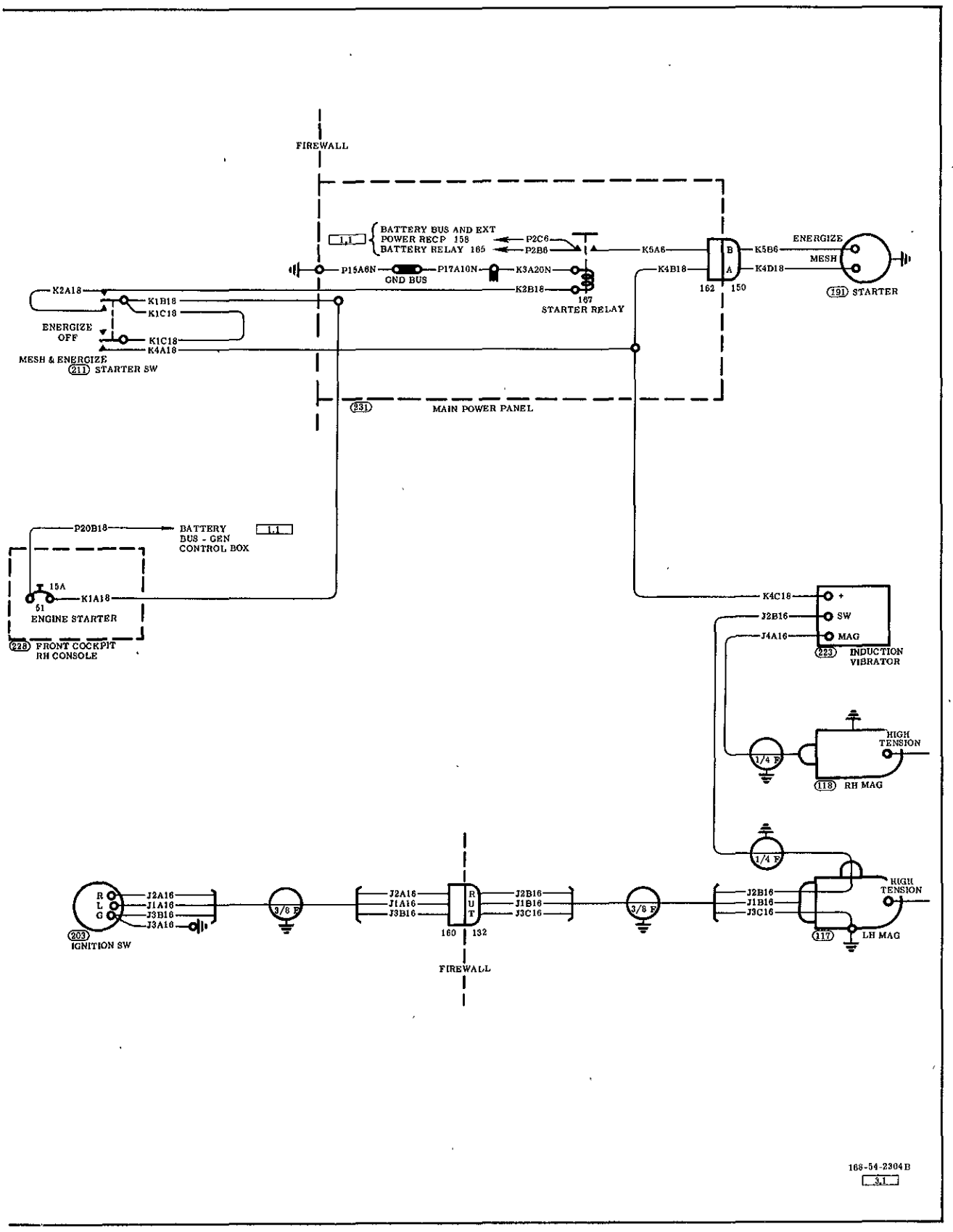
RESISTOR RELOCATED ON EXTERIOR OF GENERATOR CONTROL PANEL, AIRPLANES AF51-14401 THROUGH AF51-15137. THE RESISTOR'S VALUE IS CHANGED TO 0.125 OHMS 125 WATTS, AIRPLANES AF51-14508 THROUGH AF51-15137.

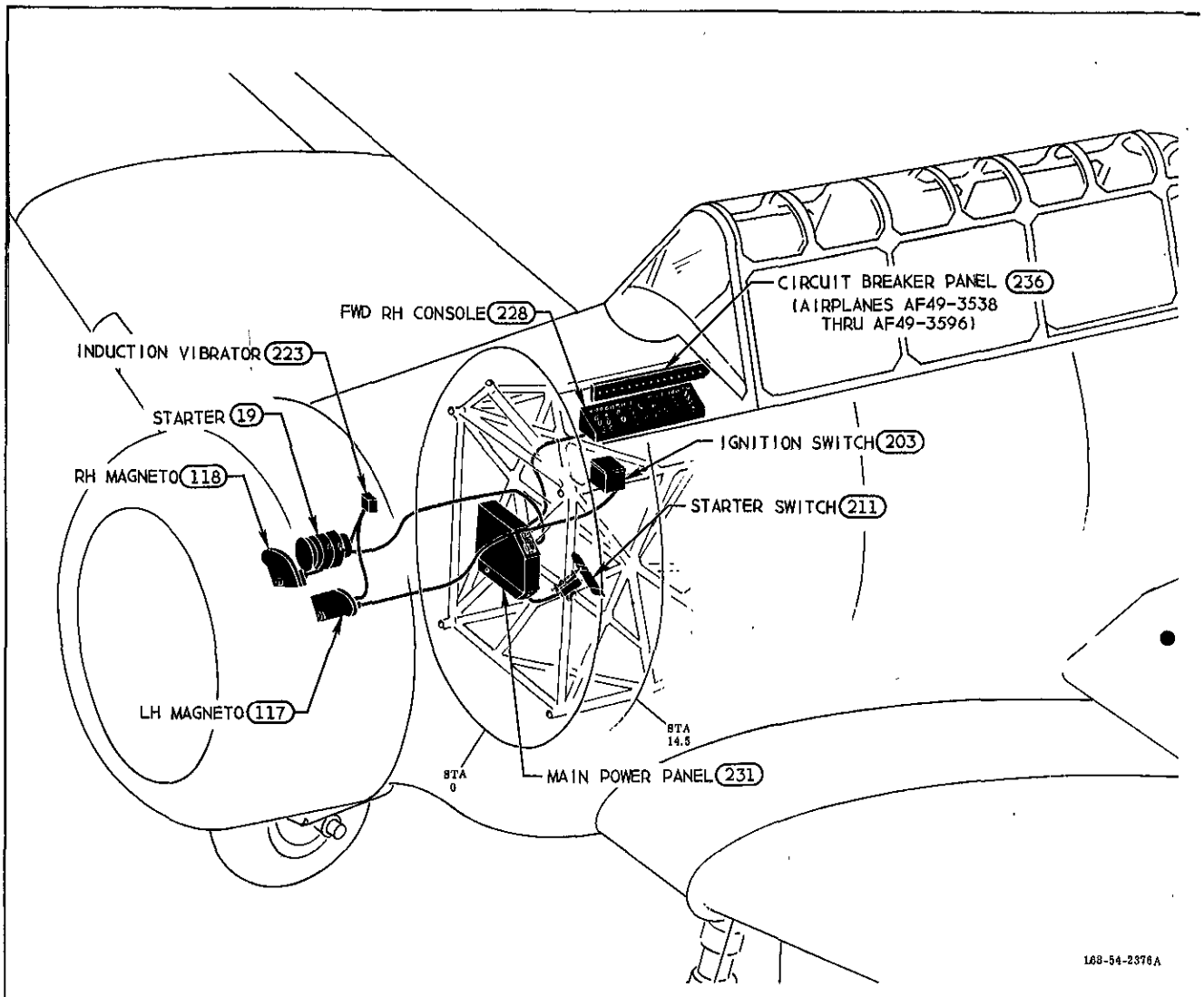
AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
51	Circuit Breaker - Starter	AN3161-P15
117	Magneto - Left-hand Ignition	
118	Magneto - Right-hand Ignition	
132	Plug - Ignition Switch	35A2533
150	Plug - Starter Power Panel Disconnect	2083-25 (Cannon)
160	Receptacle - Ignition Switch	E1156-3-10 (Breeze)
162	Receptacle - Starter Power Panel Disconnect	2065-26 (Cannon)
165	Relay - Battery B-4	94-32324
167	Relay- Starter B-8	94-32424
191	Starter - G-5	95-32303
203	Switch - Ignition A-7	32090
211	Switch - Starter	AN3023-7
223	Vibrator - Induction	VJR24B5X (American Bosch), GE70G163 (General Electric)
228	Console - Forward Right-hand	168-54005 (NAA)
231	Panel - Main Power	168-54072 (NAA)

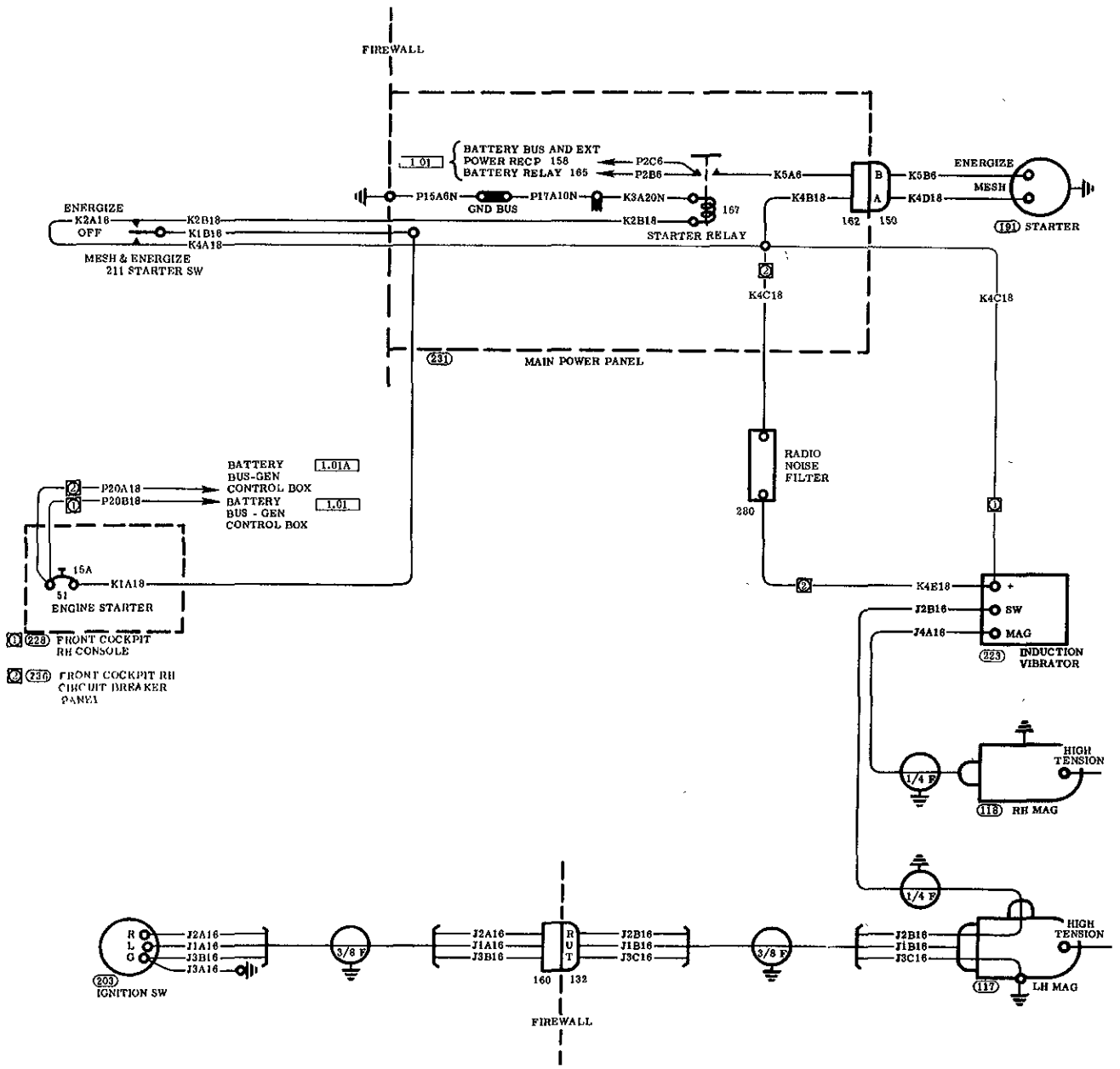
Figure 8-4. Starter and Ignition System -


FIREWALL
BATTERY BUS AND EXT POWER RECP 158
BATTERY RELAY 165
P2C6
P2B6
K5A6
B
A
K5B6
K4D18
K4B18
ENERGIZE
MESH
162
150
191 STARTER
P15A8N
GND BUS
P17A10N
K3A20N
K2B18
167
STARTER RELAY
K2A18
K1B18
K1C18
ENERGIZE
OFF
K1C18
K4A18
MESH & ENERGIZE
211 STARTER SW
231 MAIN POWER PANEL
P20B18
BATTERY
BUS - GEN
CONTROL BOX
15A
K1A18
51
ENGINE STARTER
228 FRONT COCKPIT
RH CONSOLE
K4C18
+
J2B16
SW
J4A16
MAG
223 INDUCTION
VIBRATOR
HIGH
TENSION
1/4 F
118 RH MAG
R
L
G
J2A16
J1A16
J3B16
J3A16
203
IGNITION SW
3/8 F
J2A16
J1A16
J3B16
R
U
T
J2B16
J1B16
J3C16
160
132
FIREWALL
J2B16
J1B16
J3C16
HIGH
TENSION
117 LH MAG
168-54-2304B
3.1



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
51	Circuit Breaker - Starter	AN3161-P15
117	Magneto - Left-hand Ignition	
118	Magneto - Right-hand Ignition	
132	Plug - Ignition Switch	35A2533
150	Plug - Starter Power Panel Disconnect	2083-25 (Cannon)
160	Receptacle - Ignition Switch	E1156-3-10 (Breeze)
162	Receptacle - Starter Power Panel Disconnect	2065-26 (Cannon)
165	Relay - Battery B-4	94-32324
167	Relay - Starter Type B-8	94-32424
191	Starter - G-5	95-32303
203	Switch - Ignition A-7	32090
211	Switch - Starter	AN3022-7
223	Vibrator - Induction	VJR24B5X (American Bosch), GE70G163 (General Electric)
228	Console - Forward Right-hand	168-54005-20 (NAA)
231	Panel - Main Power	168-54072 (NAA)
236	Panel - Right-hand Forward Circuit Breaker	168-54082 (NAA)

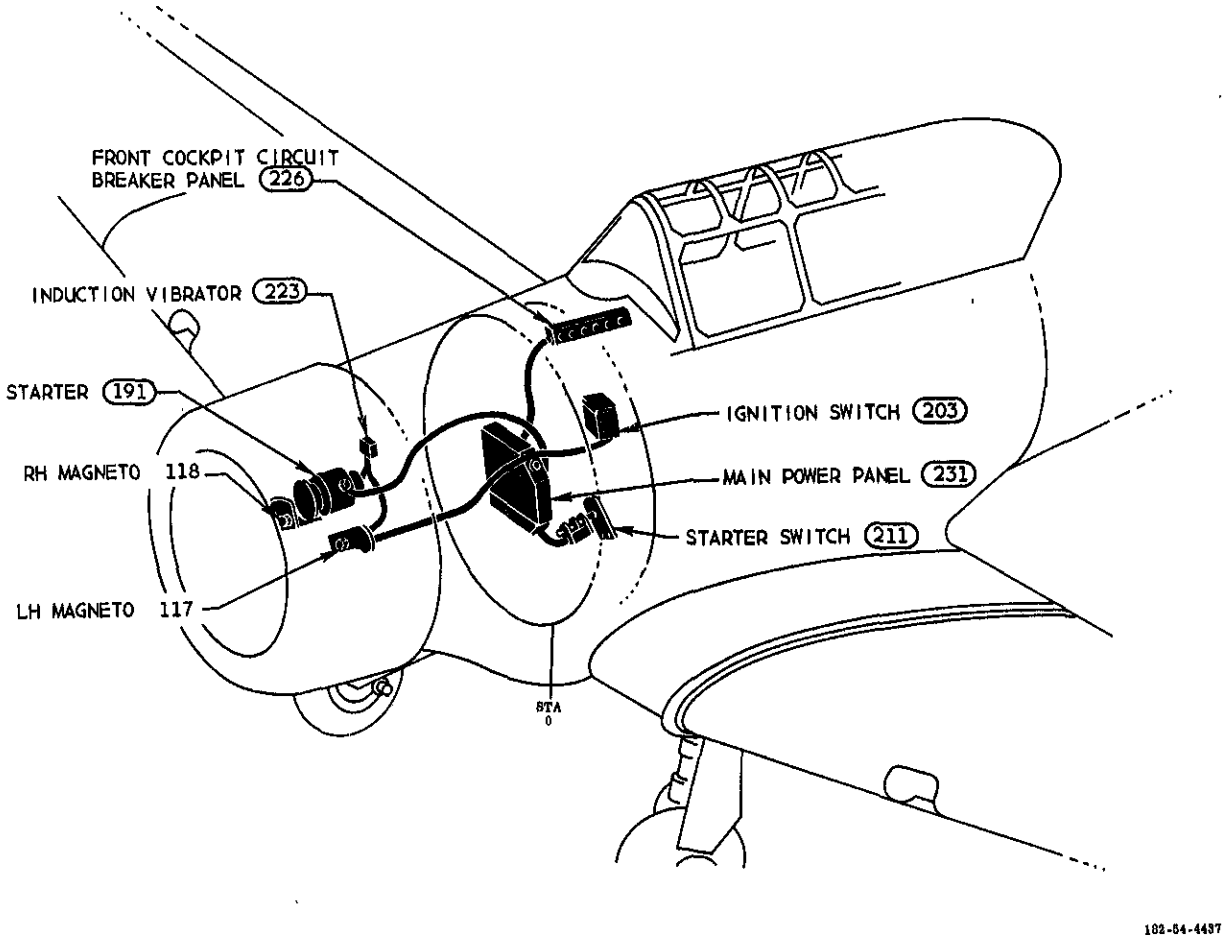
Figure 8-4A. Starter and Ignition System - Airplanes AF49-3227 Through AF49-3596, AF50-1277



1 AIRPLANES AF49-3227 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16043

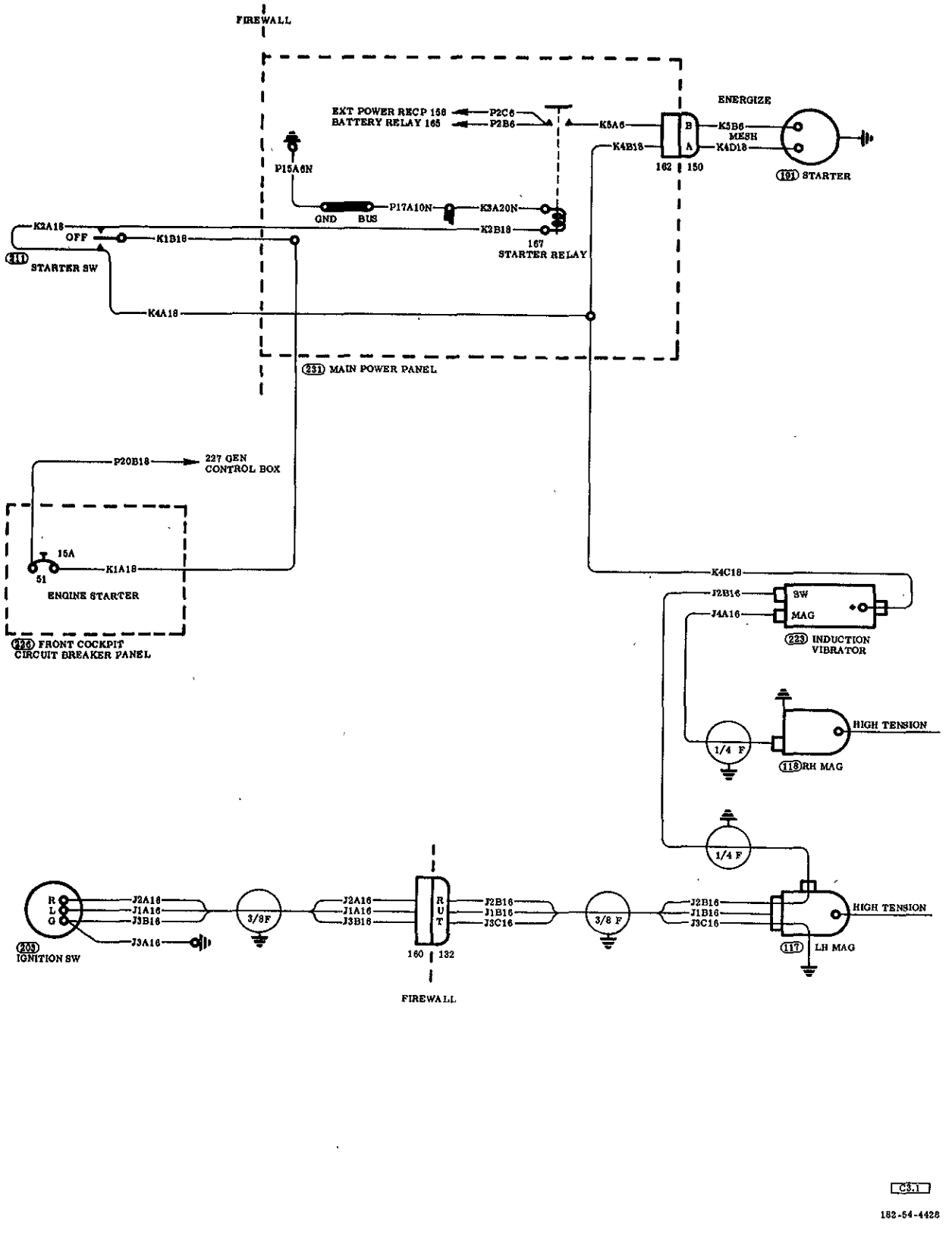
2 AIRPLANES AF49-3538 THRU AF49-3596

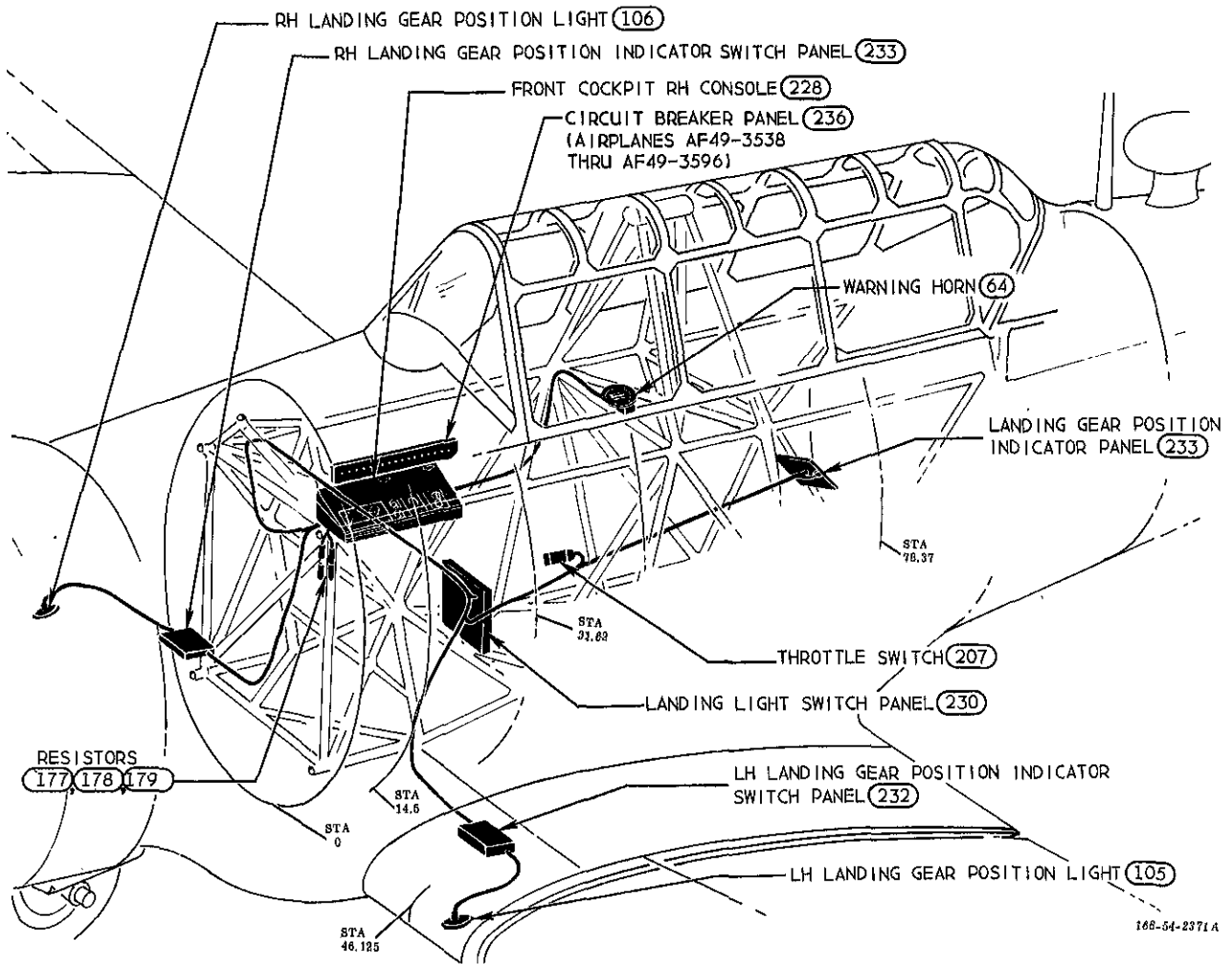
168-54-4096A
3.01



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
51	Circuit Breaker - Starter	AN3161-P15
117	Magneto - Left-hand Ignition	
118	Magneto - Right-hand Ignition	
132	Plug - Ignition Switch	35A2533
150	Plug - Starter Power Panel Disconnect	2083-25 (Cannon)
160	Receptacle - Ignition Switch	F1156-3-10 (Breeze)
162	Receptacle - Starter Power Panel Disconnect	2065-26 (Cannon)
167	Relay - Starter	94-32424, Type B-8 (GFP)
191	Starter	95-32303, Type G-5 (GFP)
203	Switch - Ignition	32090, Type A-7
211	Switch - Starter	AN3022-1
223	Vibrator - Induction	VJR24B5X, American-Bosch (GFP)
226	Panel - Circuit Breaker	182-54027 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)

Figure 8-4B. Starter and Ignition System - Airplanes

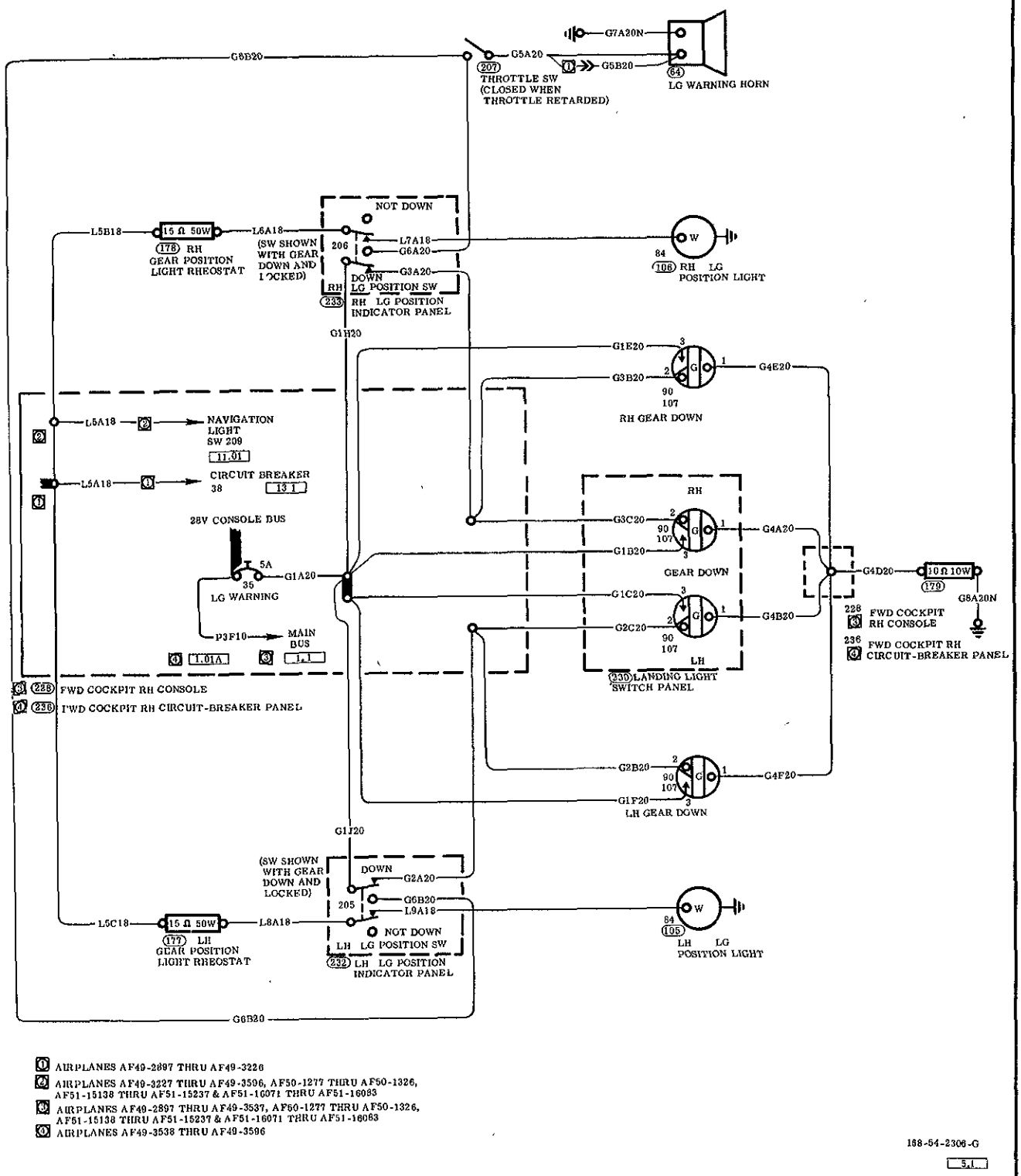

FIREWALL
EXT POWER RECP 156
BATTERY RELAY 165
P2C6
P2B6
K5A6
ENERGIZE
B
A
K5B6
MESH
K4D18
K4B18
162
150
191 STARTER
P15A6N
GND
BUS
P17A10N
K3A20N
K2B18
167
STARTER RELAY
K2A18
OFF
K1B18
411 STARTER SW
K4A18
231 MAIN POWER PANEL
P20B18
227 GEN CONTROL BOX
15A
51
K1A18
ENGINE STARTER
226 FRONT COCKPIT CIRCUIT BREAKER PANEL
K4C18
J2B16
J4A16
SW
MAG
223 INDUCTION VIBRATOR
HIGH TENSION
1/4 F
118 RH MAG
R
L
G
J2A16
J1A16
J3B16
J3A16
205 IGNITION SW
3/8 F
R
U
T
160
132
FIREWALL
J2B16
J1B16
J3C16
117 LH MAG
C3.1
182-54-4428

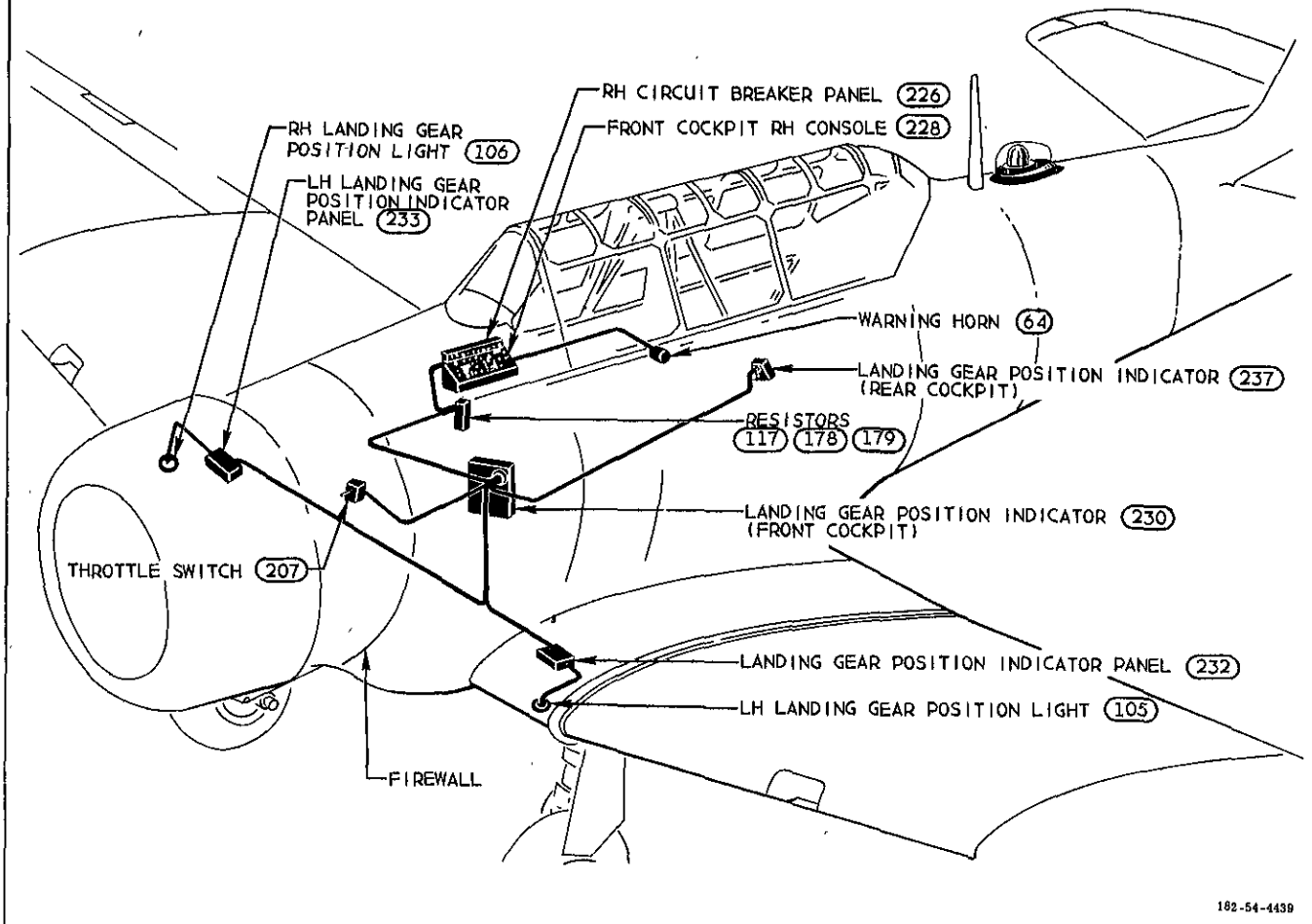


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
35	Circuit Breaker - Landing Gear Warning	AN3161-P5
38	Circuit Breaker - Navigation Light	AN3160-10
64	Horn - Landing Gear Warning	32462
84	Lamp - Landing Gear Position	305 (Mazda)
90	Lamp - Miniature	AN3121-313
105	Light Assembly - Landing Gear Position (Left-hand Gear)	A-2132 (Grimes)
106	Light Assembly - Landing Gear Position (Right-hand Gear)	A-2132 (Grimes)
107	Light Assembly - Landing Gear Safe Indicator	AN3157-3
177	Resistor - Left-hand Gear Landing Gear Position Light 15-ohm 50-watt	ABZUG (Ohmite)
178	Resistor - Right-hand Gear Landing Gear Position Light 15-ohm 50-watt	ABZUG (Ohmite)
179	Resistor - Landing Gear Safe Indicator Light 10-ohm 10-watt	ACYOU (Ohmite)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
205	Switch - Left-hand Gear Landing Gear Position	AN3023-10
206	Switch - Right-hand Gear Landing Gear Position	AN3023-10
207	Switch - Landing Gear Warning Throttle	AN3022-10
209	Switch - Navigation Light	AN3227-1
228	Console - Forward Right-hand	168-54005 (NAA), 168-54005-20 (NAA)
230	Box Assembly - Alighting Gear Position Indicator	168-33523 (NAA)
232	Panel - Left-hand Landing Gear Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)
236	Panel - Right-hand Circuit Breaker	168-54082 (NAA)

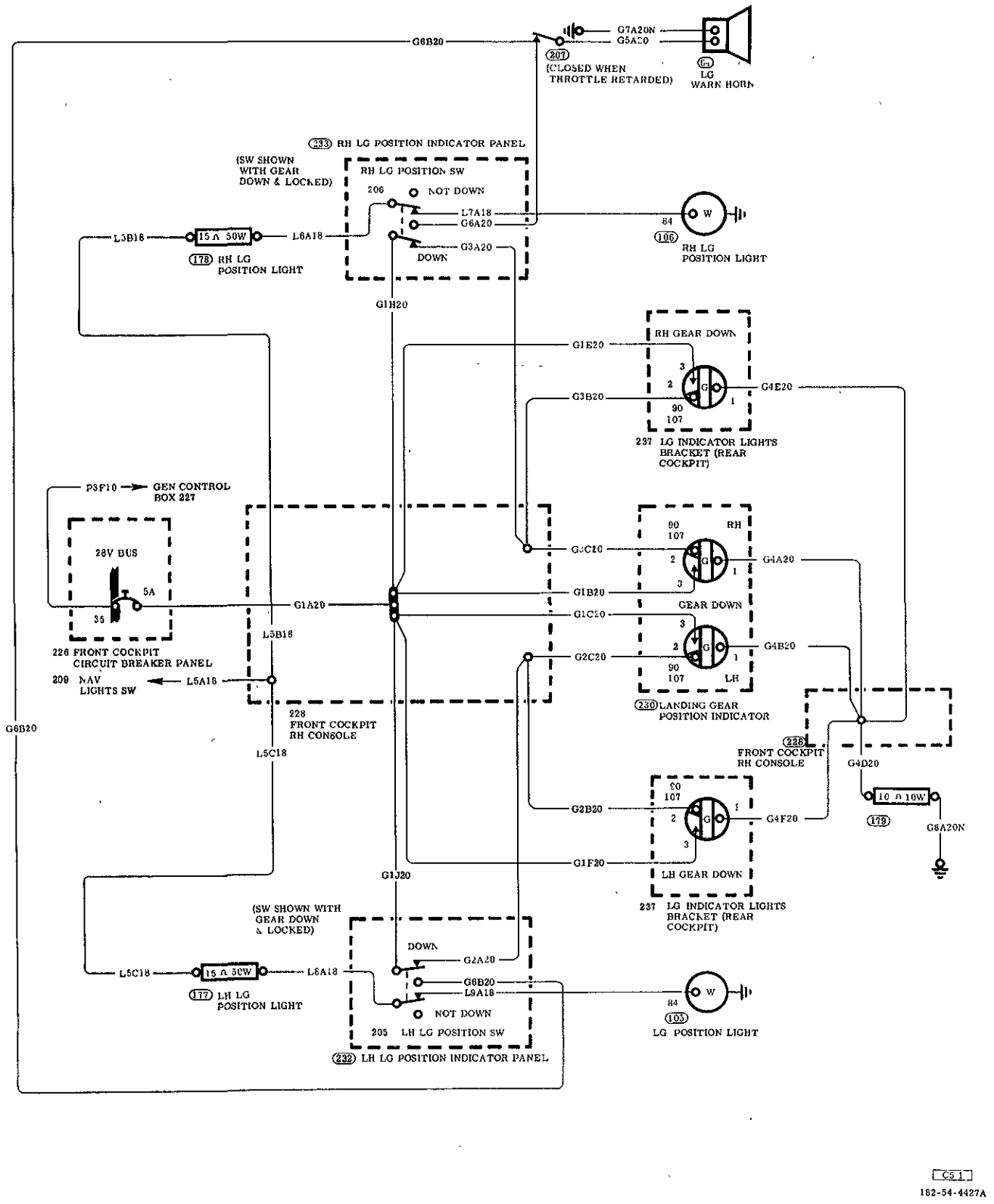
Figure 8-5. Landing Gear, Lights, and Horn - Airplanes AF49-2897 Through AF49-3596, AF50-1277


G7A20N
G5A20
G5B20
G6B20
207
THROTTLE SW
(CLOSED WHEN
THROTTLE RETARDED)
64
LG WARNING HORN
NOT DOWN
L5B18
15 Ω 50W
178 RH
GEAR POSITION
LIGHT RHEOSTAT
L6A18
(SW SHOWN
WITH GEAR
DOWN AND
LOCKED)
206
L7A18
G6A20
G3A20
DOWN
RH LG POSITION SW
233 RH LG POSITION
INDICATOR PANEL
W
84
106 RH LG
POSITION LIGHT
G1H20
G1E20
G3B20
G4E20
90
107
RH GEAR DOWN
L5A18
NAVIGATION
LIGHT
SW 209
11.01
CIRCUIT BREAKER
38
13.1
28V CONSOLE BUS
5A
35
G1A20
LG WARNING
P3F10
MAIN
BUS
1.01A
1.1
228 FWD COCKPIT RH CONSOLE
236 FWD COCKPIT RH CIRCUIT-BREAKER PANEL
RH
G3C20
G4A20
G1B20
GEAR DOWN
G1C20
G2C20
G4B20
LH
230 LANDING LIGHT
SWITCH PANEL
G4D20
10 Ω 10W
179
G8A20N
228 FWD COCKPIT
RH CONSOLE
236 FWD COCKPIT RH
CIRCUIT-BREAKER PANEL
G2B20
G4F20
G1F20
LH GEAR DOWN
G1J20
(SW SHOWN
WITH GEAR
DOWN AND
LOCKED)
DOWN
G2A20
205
G6B20
L9A18
NOT DOWN
LH LG POSITION SW
232 LH LG POSITION
INDICATOR PANEL
L5C18
15 Ω 50W
177 LH
GEAR POSITION
LIGHT RHEOSTAT
L8A18
W
84
105
LH LG
POSITION LIGHT
G6B20
1 AIRPLANES AF49-2897 THRU AF49-3226
2 AIRPLANES AF49-3227 THRU AF49-3596, AF50-1277 THRU AF50-1326,
AF51-15138 THRU AF51-15237 & AF51-16071 THRU AF51-16083
3 AIRPLANES AF49-2897 THRU AF49-3537, AF50-1277 THRU AF50-1326,
AF51-15138 THRU AF51-15237 & AF51-16071 THRU AF51-16083
4 AIRPLANES AF49-3538 THRU AF49-3596
188-54-2306-G
5.1

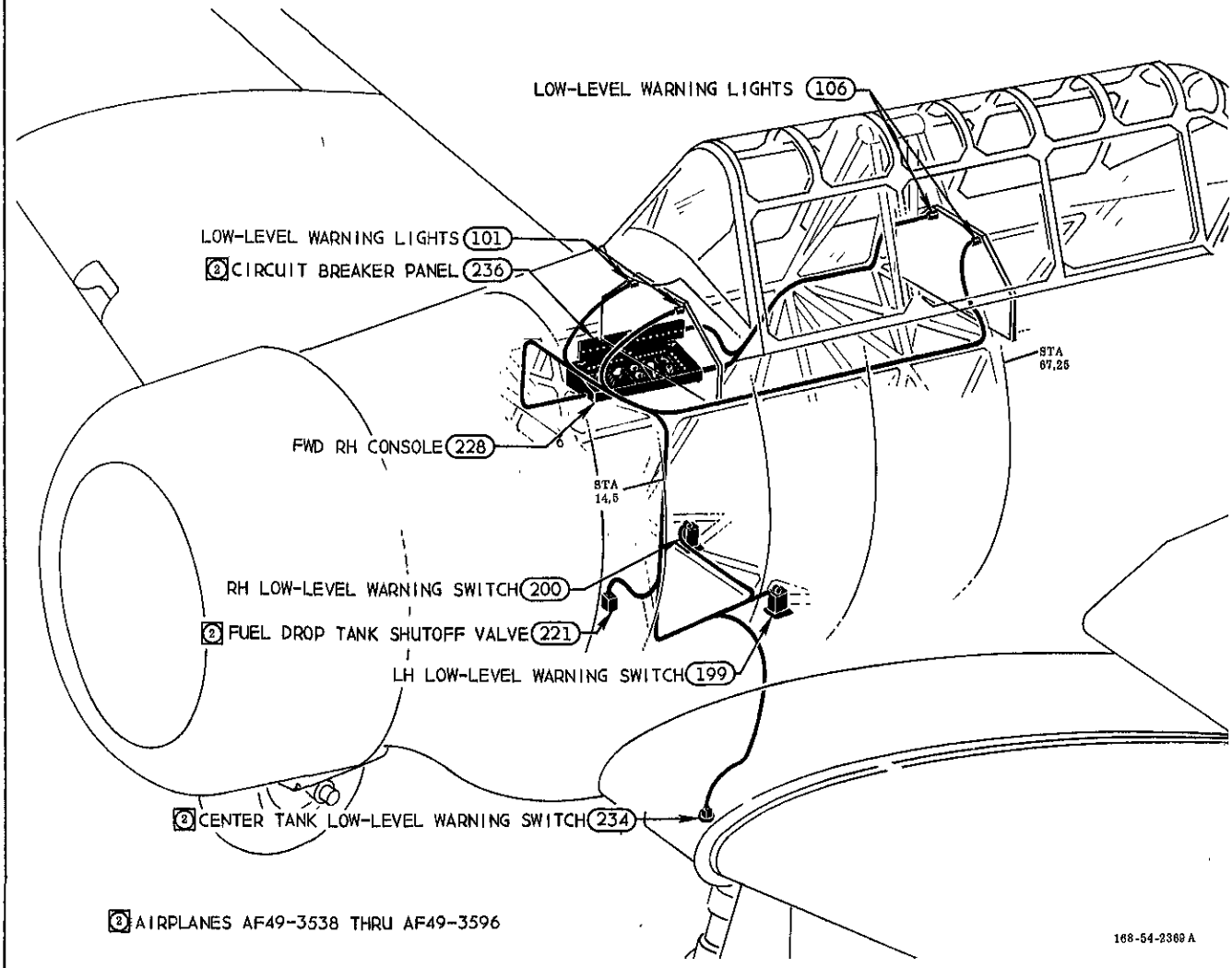


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
35	Circuit Breaker - Landing Gear Warning	AN3161-P5
64	Horn - Landing Gear Warning	32462, Type J-2
84	Lamp - Landing Gear Position	305 (Mazda)
90	Lamp - Miniature	AN3121-313
105	Light Assembly - Landing Gear Position (Left-hand Gear)	A-2132 (Grimes)
106	Light Assembly - Landing Gear Position (Right-hand Gear)	A-2132 (Grimes)
107	Light Assembly - Landing Gear Safe Indicator	AN3157-3
177	Resistor - Landing Gear Position (Left-hand Gear)	ABZUG (Ohmite)
178	Resistor - Landing Gear Position (Right-hand Gear)	ABZUG (Ohmite)
179	Resistor - Landing Gear Safe Indicator Light	ACYOU (Ohmite)
205	Switch - Landing Gear Position (Left-hand Gear)	AN3023-10
206	Switch - Landing Gear Position (Right-hand Gear)	AN3023-10
207	Switch - Landing Gear Warning Throttle	AN3022-10
209	Switch - Navigation Light	AN3227-1
226	Panel - Circuit Breaker	182-54027 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
230	Box Assembly - Landing Gear Position Indicator	168-33523 (NAA)
232	Panel - Left-hand Landing Gear Position Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)
237	Bracket - Landing Gear Indicator Lights (Rear Cockpit)	168-54038 (NAA)

Figure 8-5A. Landing Gear, Lights, and Horn - Airplanes AF51-14314

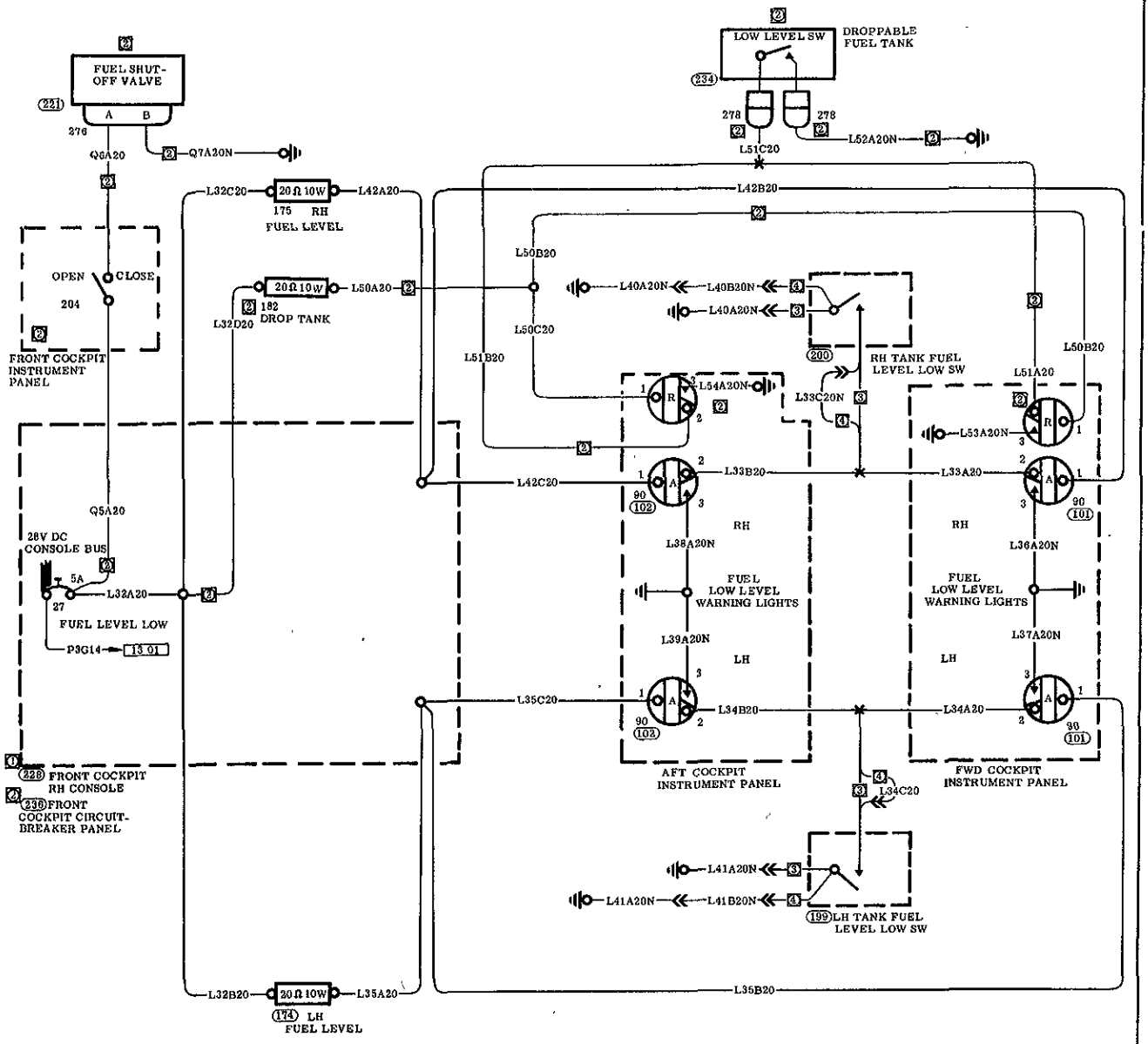


Through AF51-15137, and AF51-17354 and Subsequent



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-P5
90	Lamp - Miniature	AN3121-313
101	Light Assembly - Fuel Low-level Warning (Front)	AN3157-2
102	Light Assembly - Fuel Low-level Warning (Rear)	AN3157-2
174	Resistor - Left-hand Fuel Level Lights 20-ohm 10-watt	ACYOU (Ohmite)
175	Resistor - Right-hand Fuel Level Lights 20-ohm 10-watt	ACYOU (Ohmite)
182	Resistor - 20-ohm, 10-watt Drop Tank	(Ohmite)
199	Switch - Left-hand Fuel Low-level Warning	EA-504-BP-700 (Liquidometer)
200	Switch - Right-hand Fuel Low-level Warning	EA-504-BP-700 (Liquidometer)
204	Switch - Fuel Valve Control	AN3021-3
228	Console - Forward Right-hand	168-54005 (NAA), 168-54005-20 (NAA)
236	Panel - Right-hand Circuit Breaker	168-54082 (NAA)
276	Receptacle - Fuel Tank Valve	AN3106-10S-3S
284	Terminal Strip	

Figure 8-6. Fuel Low-level Warning System - Airplanes AF49-2897 Through AF49-3596, AF50-1277



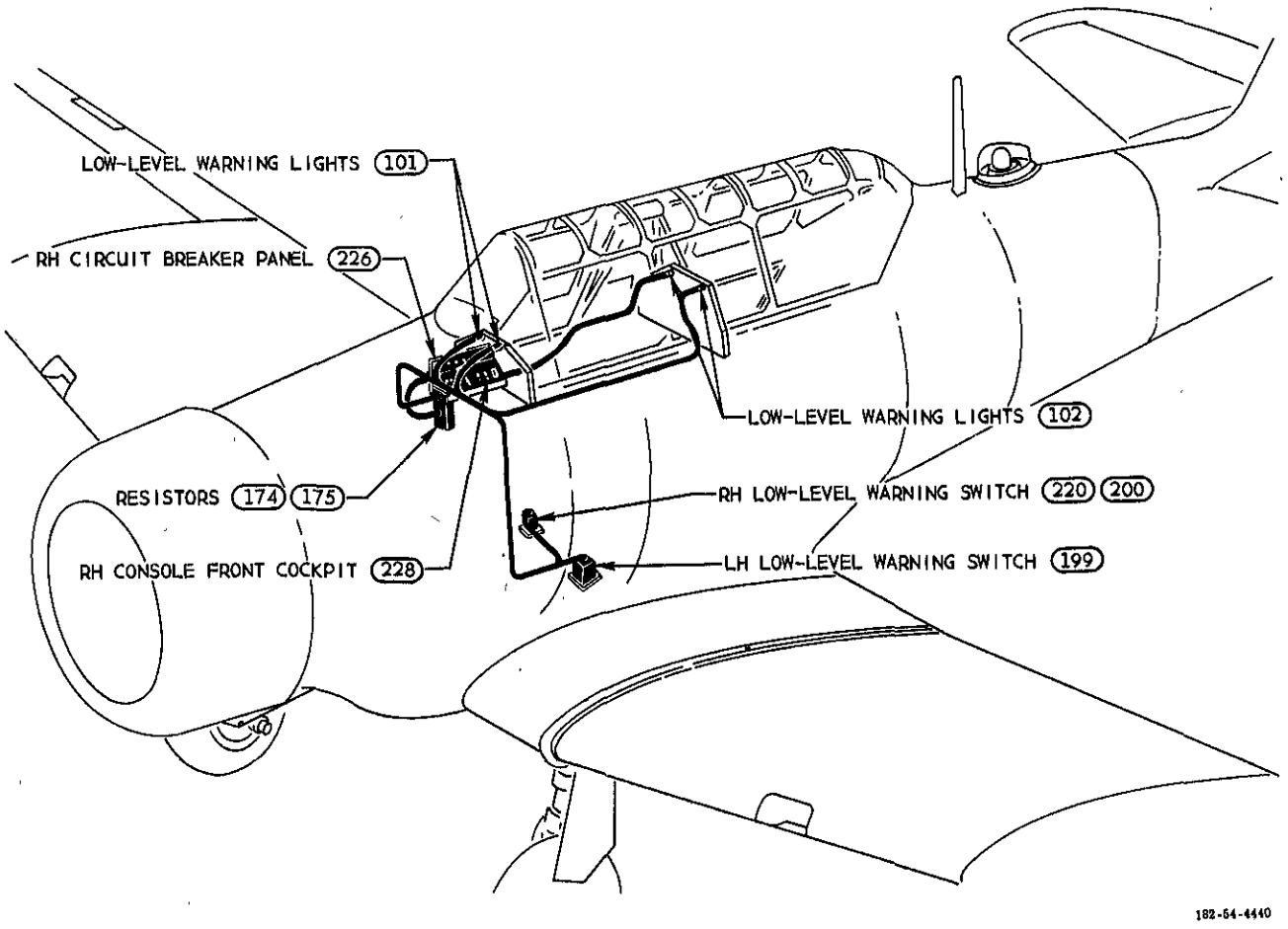
[0] AIRPLANES AF49-2697 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237 & AF51-16071 THRU AF51-16083

[2] AIRPLANES AF49-3538 THRU AF49-3596

[3] AIRPLANES AF49-2697 THRU AF49-3226

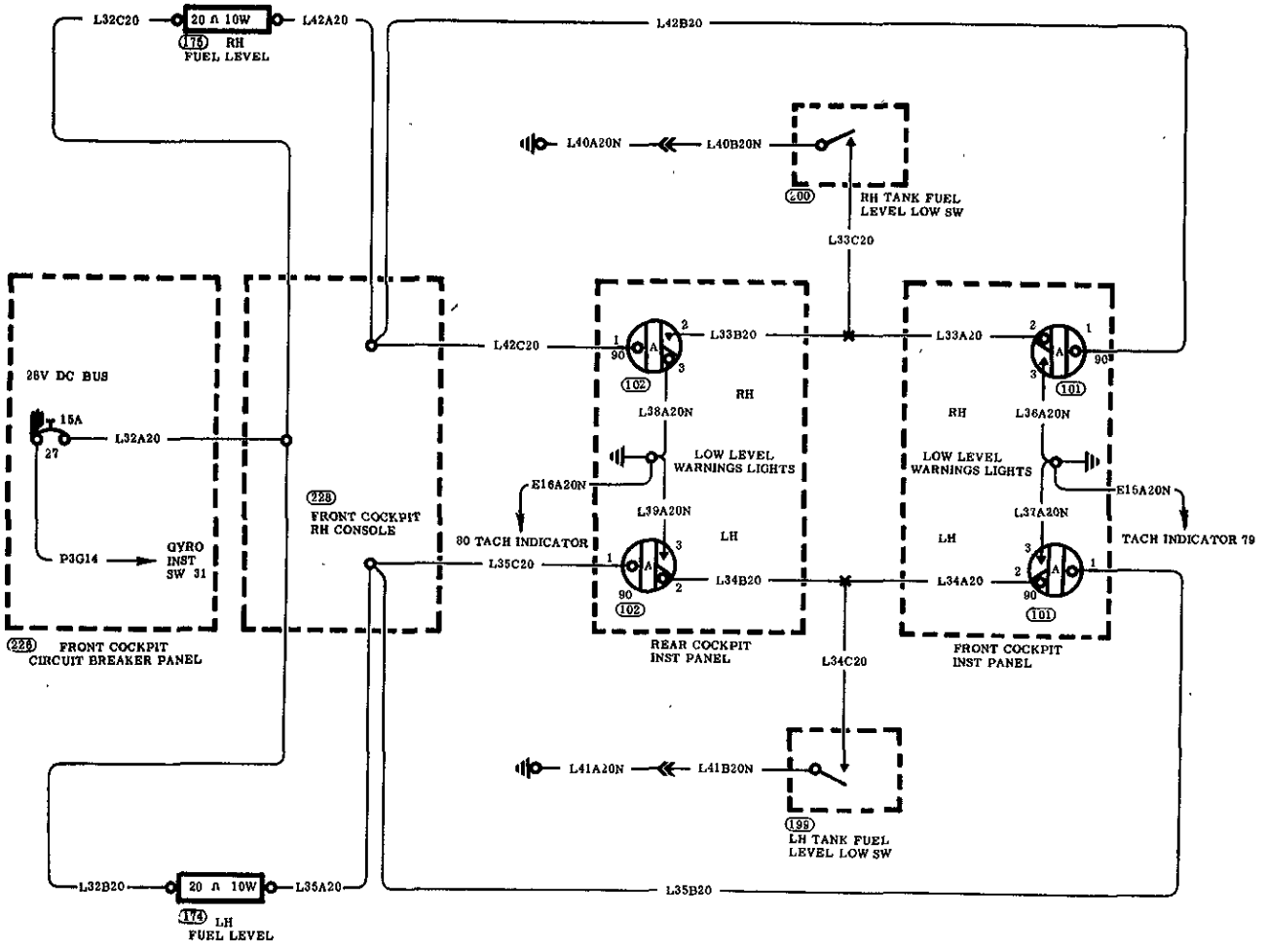
[4] AIRPLANES AF49-3227 THRU AF49-3536, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16083

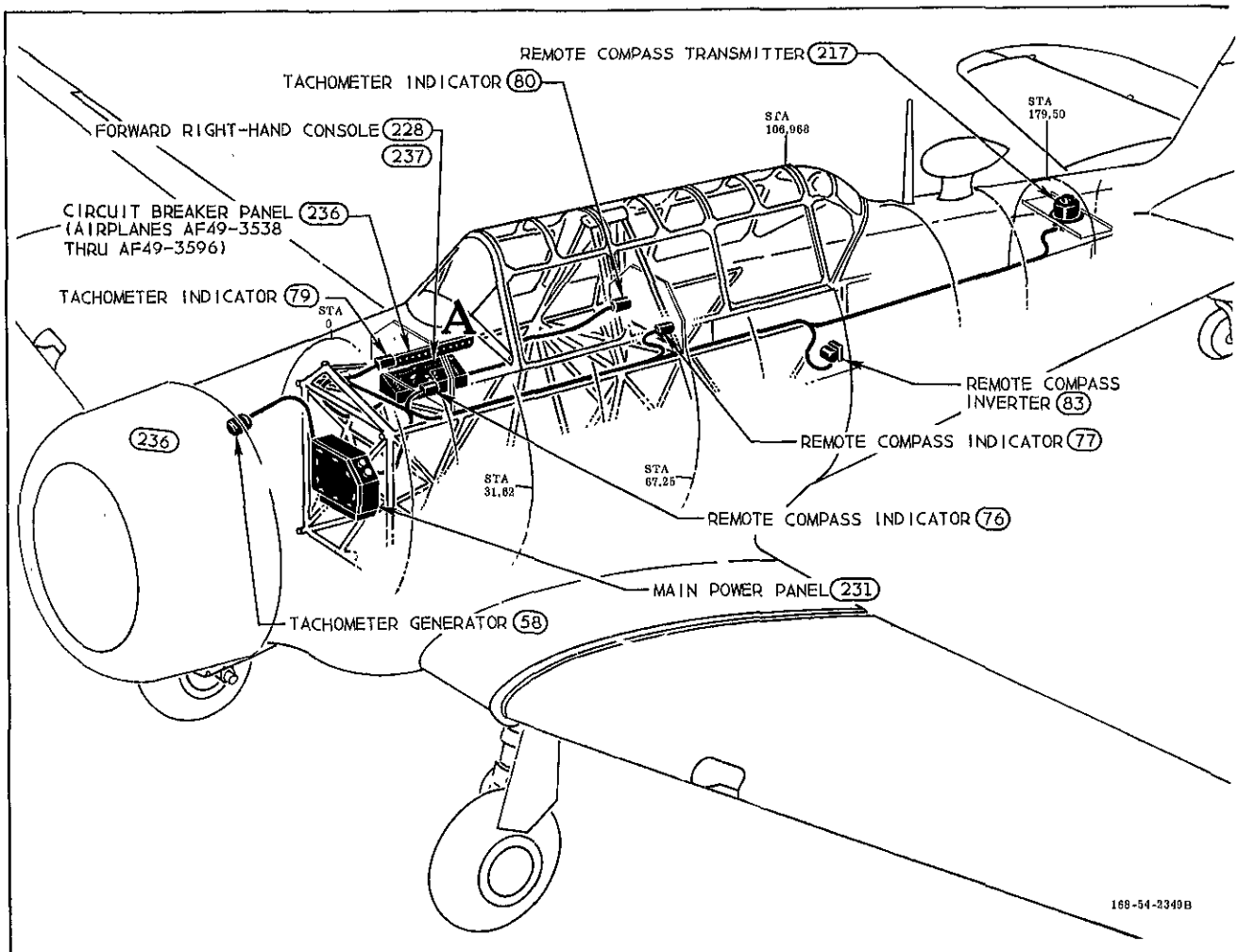
168-54-2297D
71



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
90	Lamp - Miniature	AN3121-313
101	Light Assembly - Fuel Low-level Warning (Front)	AN3157-2
102	Light Assembly - Fuel Low-level Warning (Rear)	AN3157-2
174	Resistor - Left-hand Fuel Level Lights	ACYOU (Ohmite)
175	Resistor - Right-hand Fuel Level Lights	ACYOU (Ohmite)
199	Switch - Left-hand Tank Fuel Low-level Warning	EA-504-BP-700 (Liquidometer)
200	Switch - Right-hand Tank Fuel Low-level Warning	EA-504-BP-700 (Liquidometer)
226	Panel - Circuit Breaker	182-54027 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)

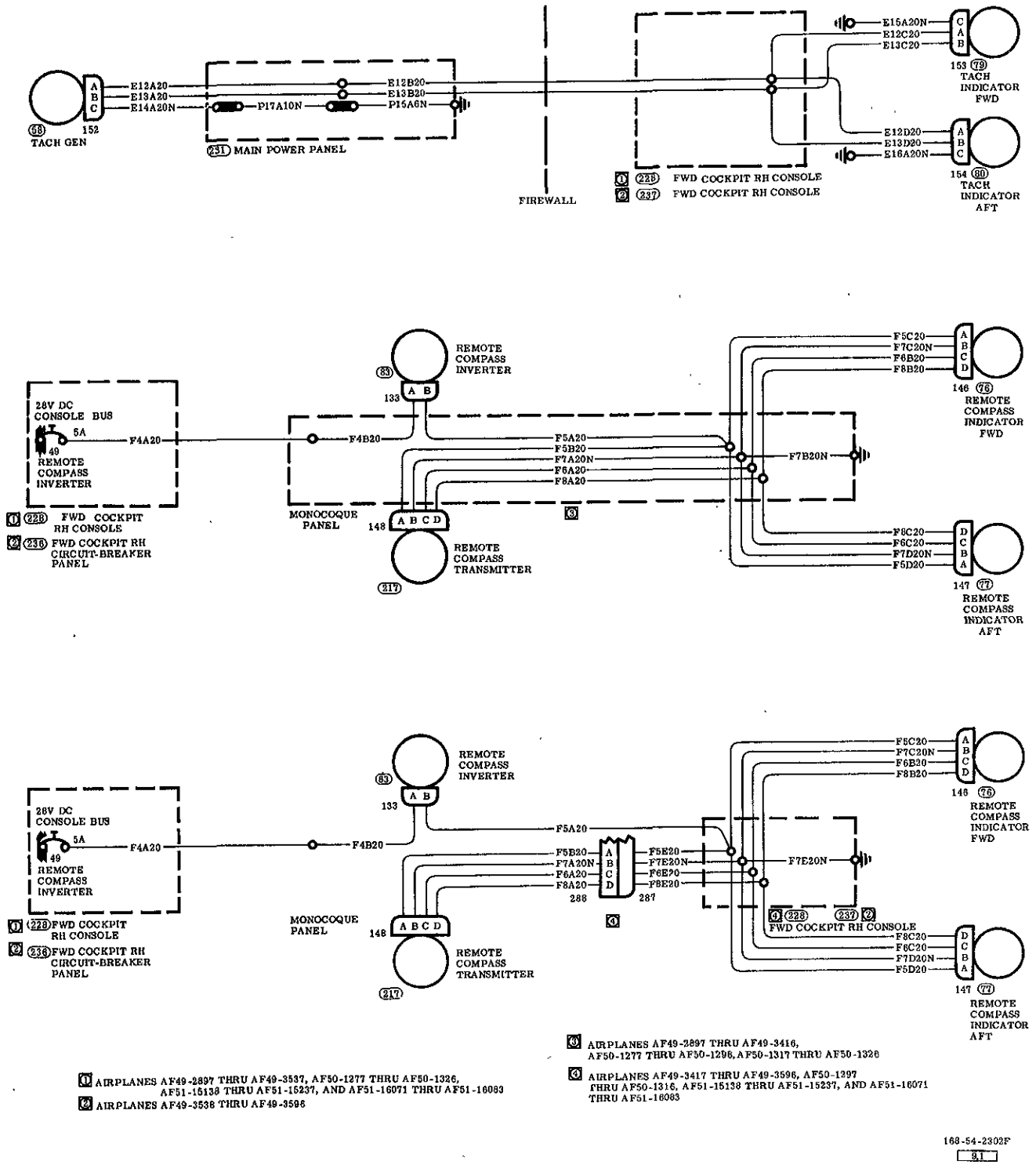
Figure 8-6A. Fuel Low-level Warning System - Airplanes

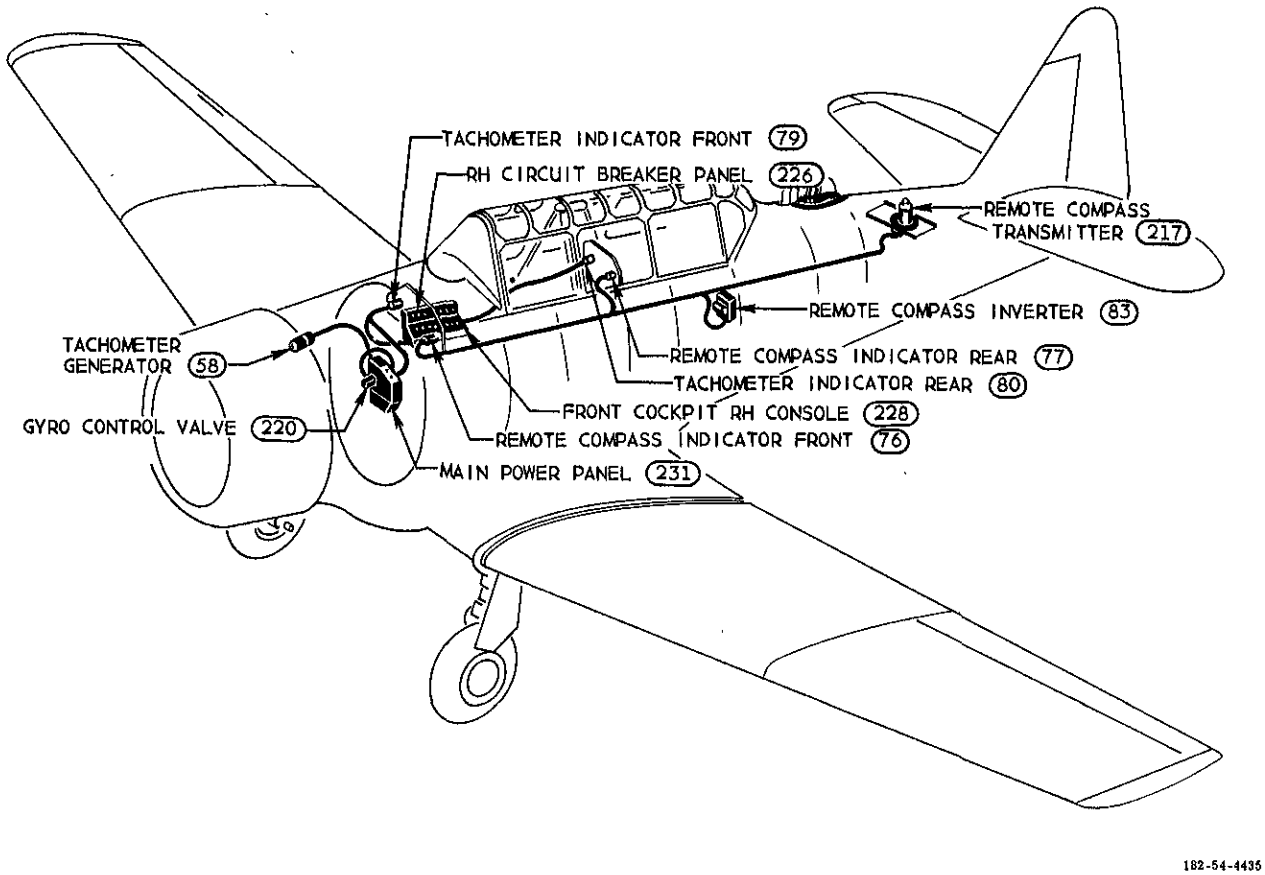

L32C20
20 Ω 10W
175 RH FUEL LEVEL
L42A20
L42B20
L40A20N
L40B20N
200 RH TANK FUEL LEVEL LOW SW
L33C20
28V DC BUS
15A
27
L32A20
P3G14
GYRO INST SW 31
226 FRONT COCKPIT CIRCUIT BREAKER PANEL
228 FRONT COCKPIT RH CONSOLE
L42C20
L33B20
L33A20
RH
L38A20N
L36A20N
LOW LEVEL WARNINGS LIGHTS
E16A20N
L39A20N
L37A20N
E15A20N
80 TACH INDICATOR
L35C20
LH
L34B20
L34A20
TACH INDICATOR 79
102 REAR COCKPIT INST PANEL
101 FRONT COCKPIT INST PANEL
L34C20
L41A20N
L41B20N
199 LH TANK FUEL LEVEL LOW SW
L32B20
20 Ω 10W
174 LH FUEL LEVEL
L35A20
L35B20
C71
182-54-4422



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	*Circuit Breaker - Fuel Low-level Warning Light*	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-P5
49	Circuit Breaker - Remote Compass Inverter	AN3161-P5
53	Circuit Breaker - Turn-and-Bank Indicator	AN3160-5
58	Generator - Tachometer	AN5531-2
76	Indicator - Remote Compass (Front Cockpit)	AN5730-6A
77	Indicator - Remote Compass (Rear Cockpit)	AN5730-6A
79	Indicator - Tachometer (Front Cockpit)	AN5530-1
80	Indicator - Tachometer (Rear Cockpit)	AN5530-1
81	*Indicator - Turn-and-Bank (Front Cockpit)*	AN5819-3
82	Indicator - Turn-and-Bank (Rear Cockpit)	AN5819-3
83	Inverter - Remote Compass	94-32270-A
133	Plug - Inverter	AN3106-12S-3S
146	Plug - Remote Compass Indicator (Front Cockpit)	AN3106-14S-2S
147	Plug - *Remote Compass Indicator* (Rear Cockpit)	AN3106-14S-2S
148	Plug - Remote Compass Transmitter	AN3106-14S-2S
152	Plug - Tachometer Generator	AN3106-14S-1S
153	Plug - Tachometer Indicator (Front Cockpit)	AN3106-14S-1S
154	Plug - Tachometer Indicator (Rear Cockpit)	AN3106-14S-1S
156	Plug - Turn-and-Bank Indicator (Front Cockpit)	AN3106-10SL-3S
157	Plug - Turn-and-Bank Indicator (Front Cockpit)	AN3106-10SL-3S
217	Transmitter - Remote Compass	AN5730-3
228	Console Assembly - Electrical and Radio (*Front Cockpit*)	168-54005 (NAA), 168-54005-20 (NAA)
231	Panel - Main Power	168-54072 (NAA)
236	Panel - Right-hand Circuit Breaker	168-54082 (NAA)
237	Console - Right-hand Forward	168-54063 (NAA)
288	Receptacle - Gun Sight	

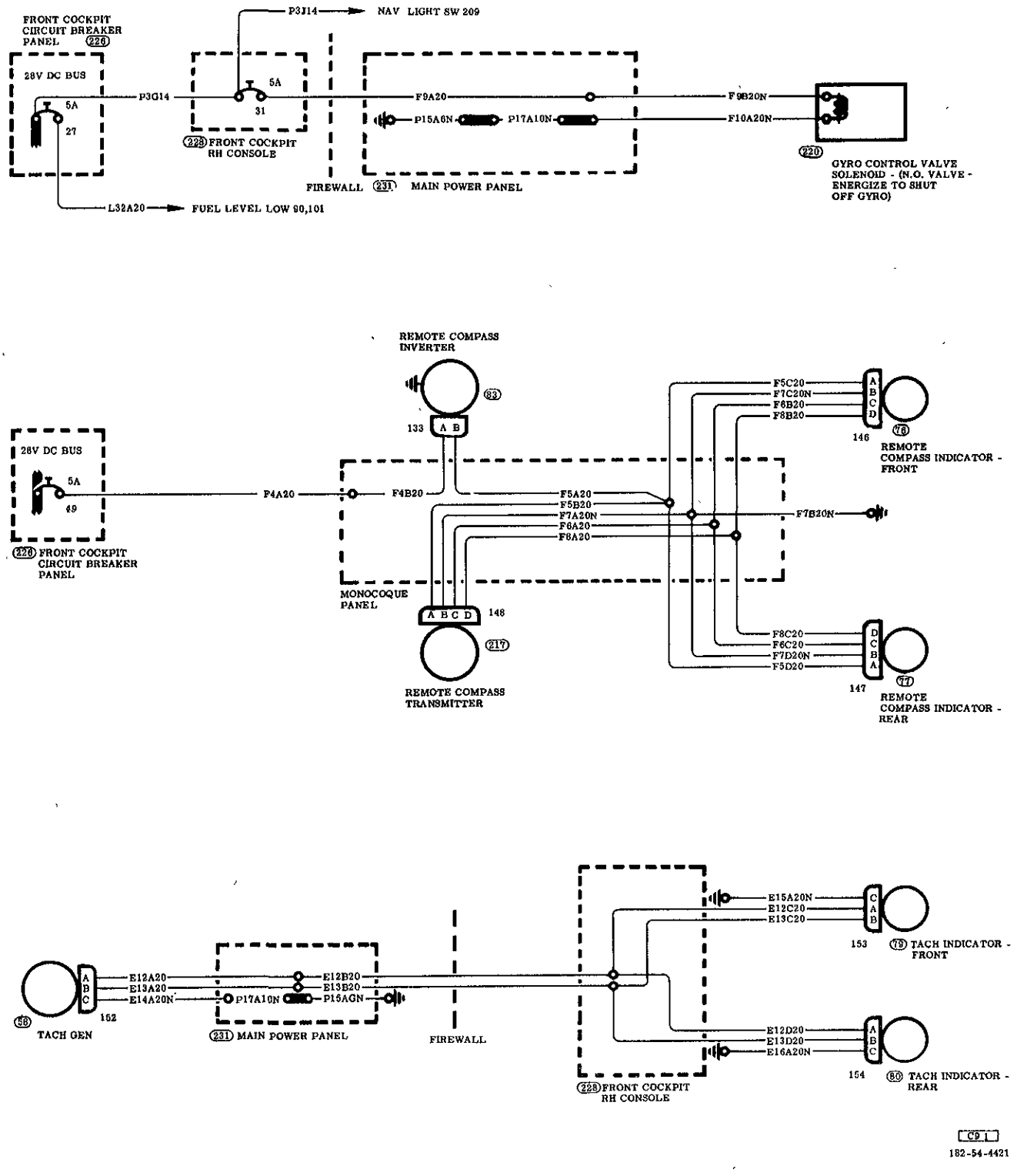
Figure 8-7 Remote Compass and Tachometer Indicators - Airplanes AF49-2897 Through AF49-3596,

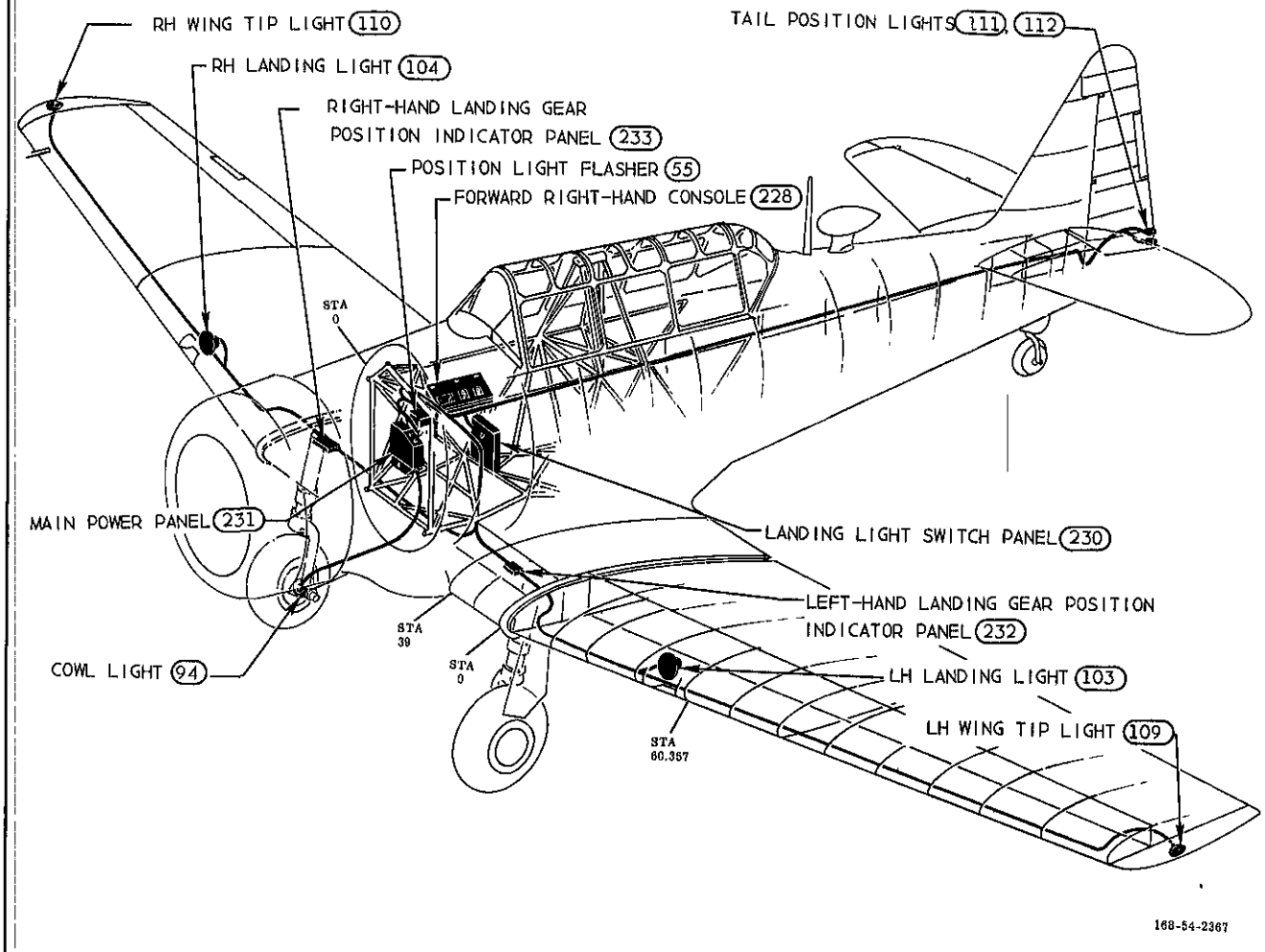

(58) TACH GEN
152
A B C
E12A20
E13A20
E14A20N
P17A10N
E12B20
E13B20
P15A6N
(231) MAIN POWER PANEL
FIREWALL
E15A20N
E12C20
E13C20
153 (79) TACH INDICATOR FWD
E12D20
E13D20
E16A20N
154 (80) TACH INDICATOR AFT
(1) (228) FWD COCKPIT RH CONSOLE
(2) (237) FWD COCKPIT RH CONSOLE
28V DC CONSOLE BUS
5A
49
F4A20
REMOTE COMPASS INVERTER
(1) (228) FWD COCKPIT RH CONSOLE
(2) (236) FWD COCKPIT RH CIRCUIT-BREAKER PANEL
(83) REMOTE COMPASS INVERTER
133
A B
F4B20
MONOCOQUE PANEL
148
A B C D
(217) REMOTE COMPASS TRANSMITTER
F5A20
F5B20
F7A20N
F6A20
F8A20
F7B20N
(3)
F5C20
F7C20N
F6B20
F8B20
146 (76) REMOTE COMPASS INDICATOR FWD
F8C20
F6C20
F7D20N
F5D20
147 (77) REMOTE COMPASS INDICATOR AFT
F5E20
F7E20N
F6E20
F8E20
287
288
F7E20N
(4) (228) (237) (2) FWD COCKPIT RH CONSOLE
(1) AIRPLANES AF49-2897 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16083
(2) AIRPLANES AF49-3538 THRU AF49-3596
(3) AIRPLANES AF49-2897 THRU AF49-3416, AF50-1277 THRU AF50-1296, AF50-1317 THRU AF50-1326
(4) AIRPLANES AF49-3417 THRU AF49-3596, AF50-1297 THRU AF50-1316, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16083
168-54-2302F
9.1



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-5
49	Circuit Breaker - Remote Compass Inverter	AN3161-P5
58	Generator - Tachometer	AN5531-2 (GFP)
76	Indicator - Remote Compass (Front Cockpit)	AN5730-6A (GFP)
77	Indicator - Remote Compass (Rear Cockpit)	AN5730-6A (GFP)
79	Indicator - Tachometer (Front Cockpit)	AN5530-1 (GFP)
80	Indicator - Tachometer (Rear Cockpit)	AN5530-1 (GFP)
83	Inverter - Remote Compass	94-32270-A (GFP)
133	Plug - Inverter	AN3106-12S-3S
146	Plug - Remote Compass Indicator (Front Cockpit)	AN3106-14S-2S
147	Plug - Remote Compass Indicator (Rear Cockpit)	AN3106-14S-2S
148	Plug - Remote Compass Transmitter	AN3106-14S-2S
152	Plug - Tachometer Generator	AN3106-14S-1S
153	Plug - Tachometer Indicator (Front Cockpit)	AN3106-14S-1S
154	Plug - Tachometer Indicator (Rear Cockpit)	AN3106-14S-1S
217	Transmitter - Remote Compass	AN5730-3 (GFP)
220	Valve - Gyro Control Solenoid	10171 (Carma)
226	Panel - Circuit Breaker	182-54027 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)

Figure 8-7A. Remote Compass and Tachometer Indicators - Airplanes

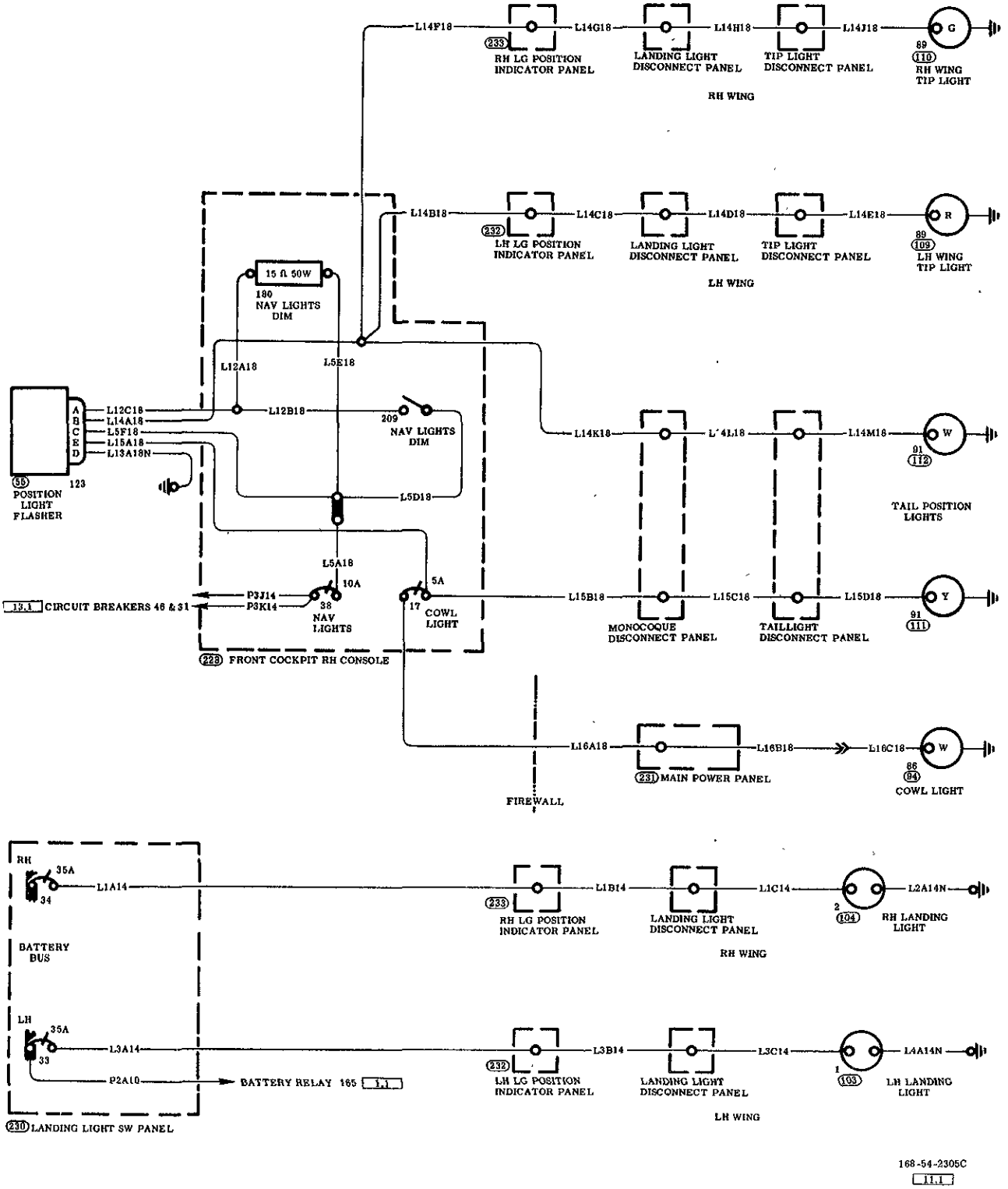

FRONT COCKPIT CIRCUIT BREAKER PANEL (226)
28V DC BUS
5A
27
P3G14
P3J14
NAV LIGHT SW 209
5A
31
(228) FRONT COCKPIT RH CONSOLE
FIREWALL
(231) MAIN POWER PANEL
F9A20
P15A6N
P17A10N
F9B20N
F10A20N
(220)
GYRO CONTROL VALVE SOLENOID - (N.O. VALVE - ENERGIZE TO SHUT OFF GYRO)
L32A20
FUEL LEVEL LOW 90,101
REMOTE COMPASS INVERTER
(83)
133
A B
28V DC BUS
5A
49
F4A20
F4B20
(226) FRONT COCKPIT CIRCUIT BREAKER PANEL
MONOCOQUE PANEL
F5A20
F5B20
F7A20N
F6A20
F8A20
F7B20N
F5C20
F7C20N
F6B20
F8B20
A B C D
146
(76)
REMOTE COMPASS INDICATOR - FRONT
A B C D
148
(217)
REMOTE COMPASS TRANSMITTER
F8C20
F6C20
F7D20N
F5D20
D C B A
147
(77)
REMOTE COMPASS INDICATOR - REAR
A B C
(58)
152
TACH GEN
E12A20
E13A20
E14A20N
P17A10N
E12B20
E13B20
P15AGN
(231) MAIN POWER PANEL
FIREWALL
E15A20N
E12C20
E13C20
G A B
153
(79) TACH INDICATOR - FRONT
E12D20
E13D20
E16A20N
A B C
154
(80) TACH INDICATOR - REAR
(228) FRONT COCKPIT RH CONSOLE
C9 1
182-54-4421

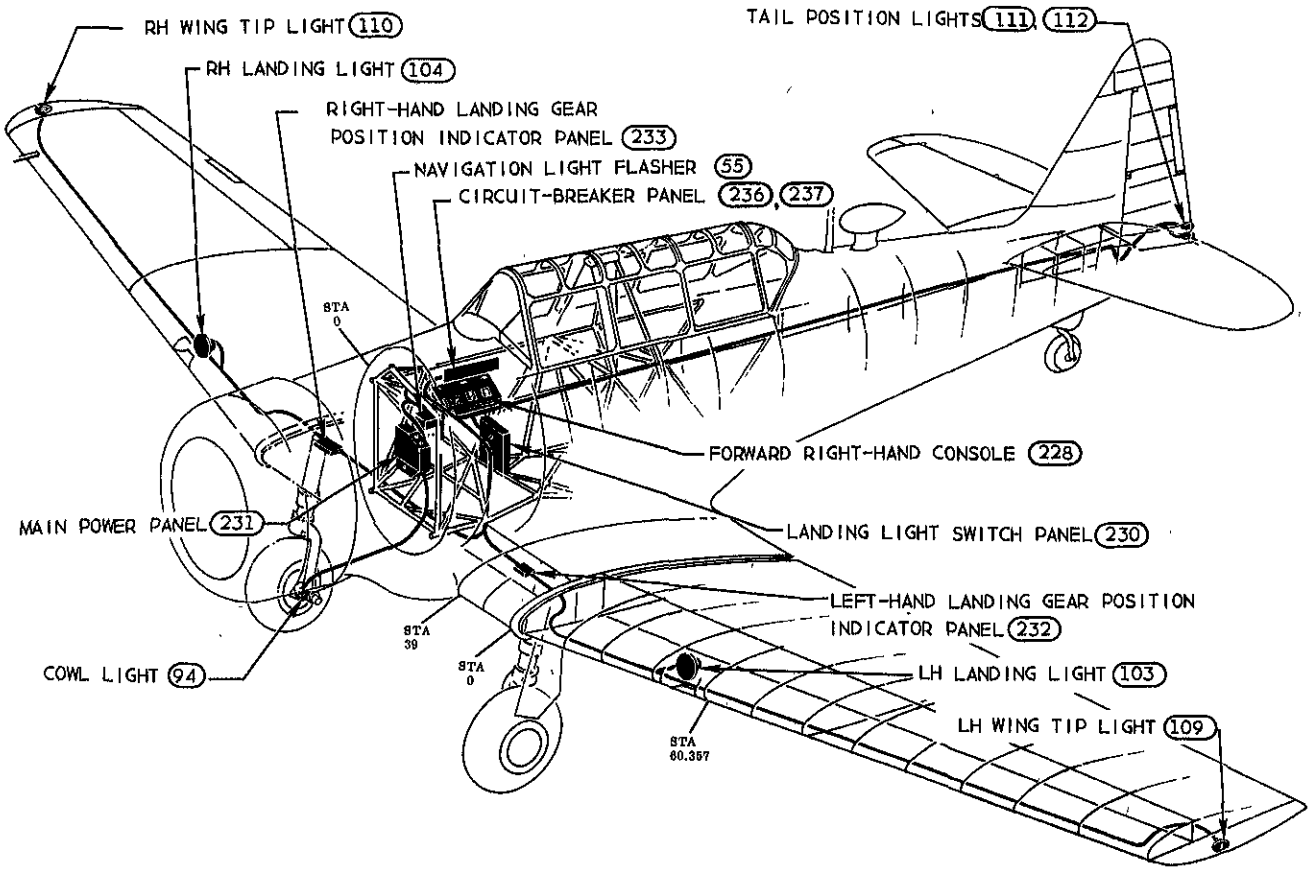


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Adapter - Left-hand Landing Light	CM-1356 (Adams & Westlake)
2	Adapter - Right-hand Landing Light	CM-1356 (Adams & Westlake)
17	Circuit Breaker - Cowl Light	AN3160-5
31	Circuit Breaker - Gyro Control Valve	AN3160-P5
33	Circuit Breaker - Left-hand Landing Light	AN3160-35
34	Circuit Breaker - Right-hand Landing Light	AN3160-35
38	Circuit Breaker - Navigation Light	AN3160-10
46	Circuit Breaker - Passing Light	AN3160-5
55	Flasher - Navigation Light	450250-0-3 (Bendix)
86	Lamp - Cowl Light	AN3133-311
89	Lamp - Wing Tip Navigation	AN3122-1524
91	Lamp- Tail Position	AN3124-307
94	Light Assembly - Cowl (White)	AN3097-3
103	Light Assembly - Left-hand Landing 450-watt	4541 (General Electric)
104	Light Assembly - Right-hand Landing 450-watt	4541 (General Electric)

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
109	Light Assembly - Left Wing Navigation (Red)	AN3133-3
110	Light Assembly - Right Wing Navigation (Green)	AN3033-4
111	Light Assembly - Tail Navigation (Yellow)	AN3158-2
112	Light Assembly - Tail Navigation (White)	AN3158-1
123	Plug - Flasher	AN3106-14S-5S
165	Relay - Battery B-4	94-32324
180	Resistor - Navigation Light Dimming 15-ohm 50-watt	ABZUG (Ohmite)
209	Switch - Navigation Light Dimming	AN3027-2
228	Console - Forward Right-hand	168-54005 (NAA)
230	Box Assembly - Alighting Gear Position Indicators	168-33523 (NAA)
231	Panel - Main Power	168-54702 (NAA)
232	Panel - Left-hand Landing Gear Position Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)

Figure 8-8. Navigation, Cowl, and Landing Lights -

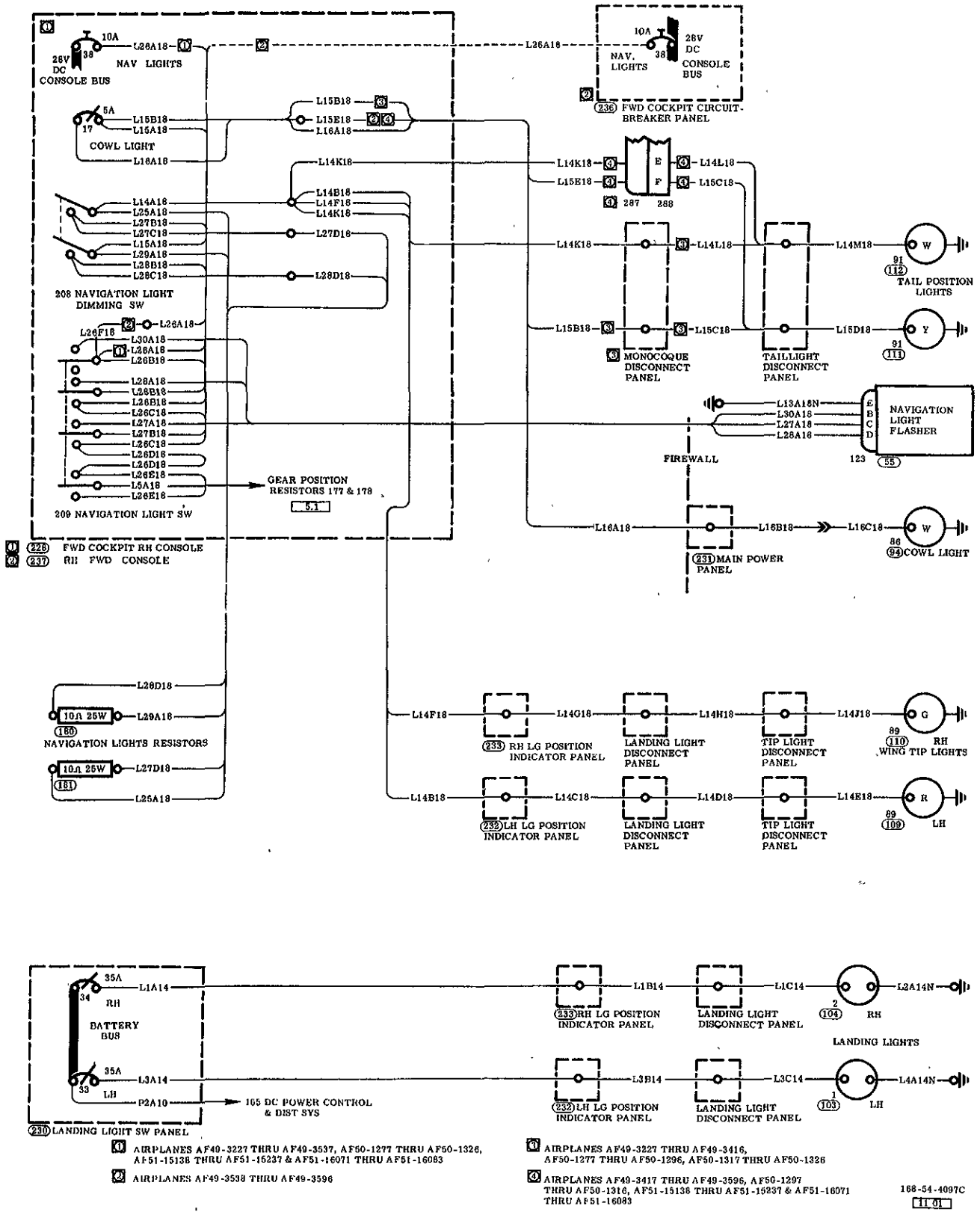

L14F18
L14G18
L14H18
L14J18
233
RH LG POSITION INDICATOR PANEL
LANDING LIGHT DISCONNECT PANEL
TIP LIGHT DISCONNECT PANEL
G
69
110
RH WING TIP LIGHT
RH WING
L14B18
L14C18
L14D18
L14E18
232
LH LG POSITION INDICATOR PANEL
LANDING LIGHT DISCONNECT PANEL
TIP LIGHT DISCONNECT PANEL
R
89
109
LH WING TIP LIGHT
LH WING
15 Ω 50W
180
NAV LIGHTS DIM
L12A18
L5E18
A
B
C
E
D
L12C18
L14A18
L5F18
L15A18
L13A18N
L12B18
209
NAV LIGHTS DIM
55
POSITION LIGHT FLASHER
123
L5D18
L14K18
L14L18
L14M18
W
91
112
TAIL POSITION LIGHTS
L5A18
10A
5A
13.1
CIRCUIT BREAKERS 46 & 31
P3J14
P3K14
38
NAV LIGHTS
17
COWL LIGHT
L15B18
L15C18
L15D18
Y
91
111
MONOCOQUE DISCONNECT PANEL
TAILLIGHT DISCONNECT PANEL
229
FRONT COCKPIT RH CONSOLE
L16A18
L16B18
L16C18
W
86
94
COWL LIGHT
231
MAIN POWER PANEL
FIREWALL
RH
35A
34
L1A14
BATTERY BUS
L1B14
L1C14
L2A14N
233
RH LG POSITION INDICATOR PANEL
LANDING LIGHT DISCONNECT PANEL
2
104
RH LANDING LIGHT
RH WING
LH
35A
33
L3A14
P2A10
BATTERY RELAY 165
1.1
L3B14
L3C14
L4A14N
232
LH LG POSITION INDICATOR PANEL
LANDING LIGHT DISCONNECT PANEL
1
103
LH LANDING LIGHT
LH WING
230
LANDING LIGHT SW PANEL
168-54-2305C
11.1



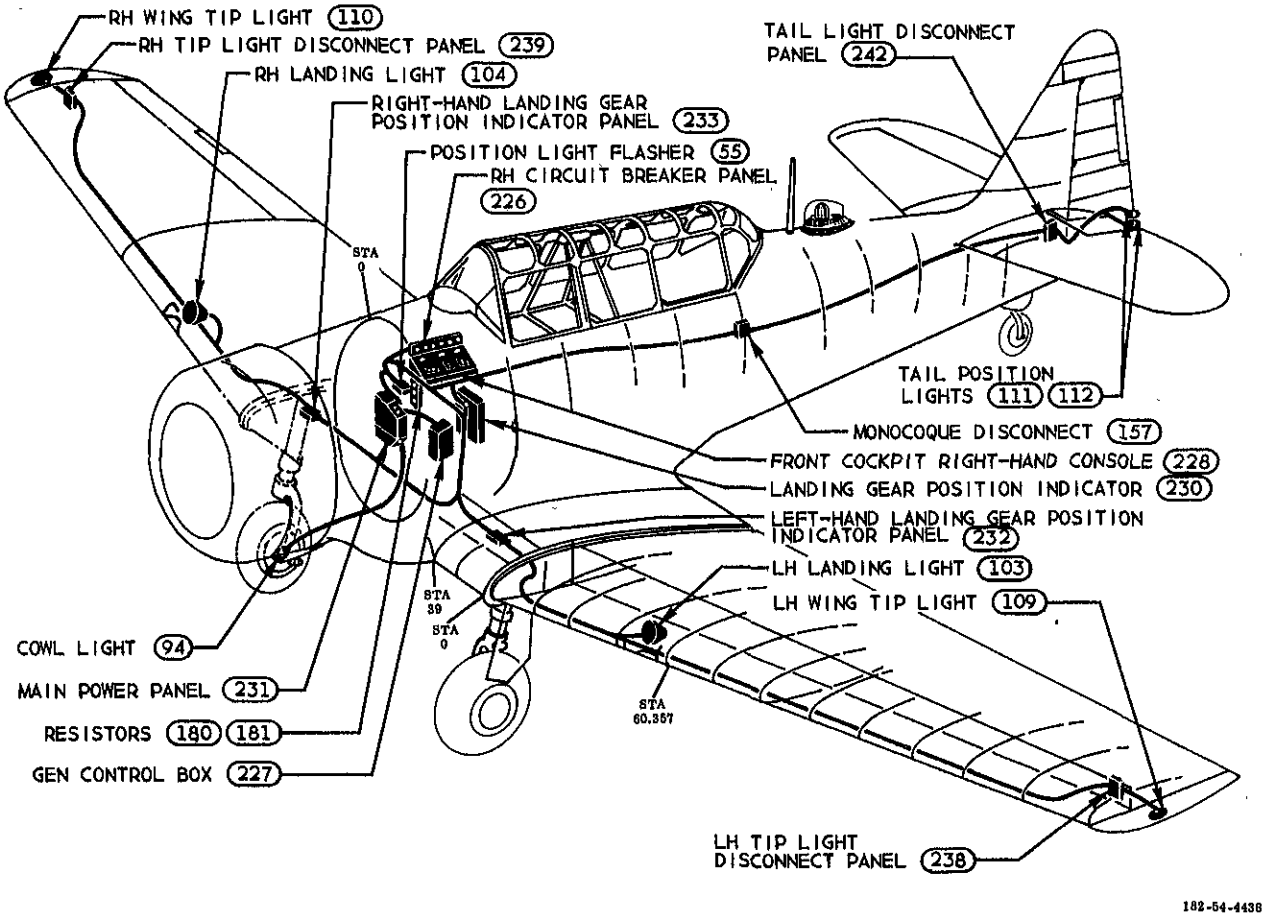
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	*Adapter - Left-hand Landing Light*	*CM-1358 (Adams Westlake)*
2	Adapter - Right-hand Landing Light	CM-1356 (Adams Westlake)
17	Circuit Breaker - Cowl Light	AN3160-5
33	Circuit Breaker - Left-hand Landing Light	AN3160-35
34	Circuit Breaker - Right-hand Landing Light	AN3160-35
38	Circuit Breaker - Navigation Light	AN3161-P10
55	Flasher - Navigation Light Type C-2	32260 (Bendix)
86	Lamp - Cowl Light	AN3133-311
89	Lamp - Wing Tip Navigation	AN3122-1524
91	Lamp - Tail Position	AN3124-307
94	Light Assembly - Cowl (White)	AN3097-3
103	Light Assembly - Left-hand Landing - 450-watt	4541 (General Electric)
104	Light Assembly - *Right-hand Landing* - 450-watt	4541 (General Electric)
109	Light Assembly - Left Wing Navigation (Red)	AN3133-3
110	Light Assembly - Right Wing Navigation (Green)	AN3033-4
111	Light Assembly - Tail Navigation (Yellow)	AN3158-2

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
112	*Light Assembly - Tail Navigation (White)*	*AN3158-1*
123	Plug- Flasher	AN3106A-16S-8S
165	Relay - Battery Type B-4	94-32324
177	Resistor - Left-hand Gear Landing Gear Position Light 15-ohm 50-watt	ABZUG (Ohmite)
180	Resistor - Navigation Light Dimming 10-ohm 25-watt	0200B
181	Resistor - Navigation Light Dimming 10-ohm 25-watt	0200B
208	Switch - Navigation Light Dimming	AN3027-2
209	Switch - Navigation Light	AN3227-1
228	Console - Forward Right-hand	168-54005-20 (NAA)
230	Box Assembly - Alighting Gear Position Indicators	168-33523 (NAA)
231	Panel - Main Power	168-54072 (NAA)
232	Panel - Left-hand Landing Gear Position *Indicator*	*168-54025-1 (NAA)*
233	Panel - Right-hand Landing Gear Position Indicator	168-54026-2 (NAA)
236	Panel - Right-hand Forward Circuit-breaker	168-54062 (NAA)
237	Console Assembly - Electrical and Radio (Front Cockpit)	168-54063 (NAA)

Figure 6-8A. Navigation, Cowl, and Landing Lights - Airplanes AF49-3227 Through AF49-3596,



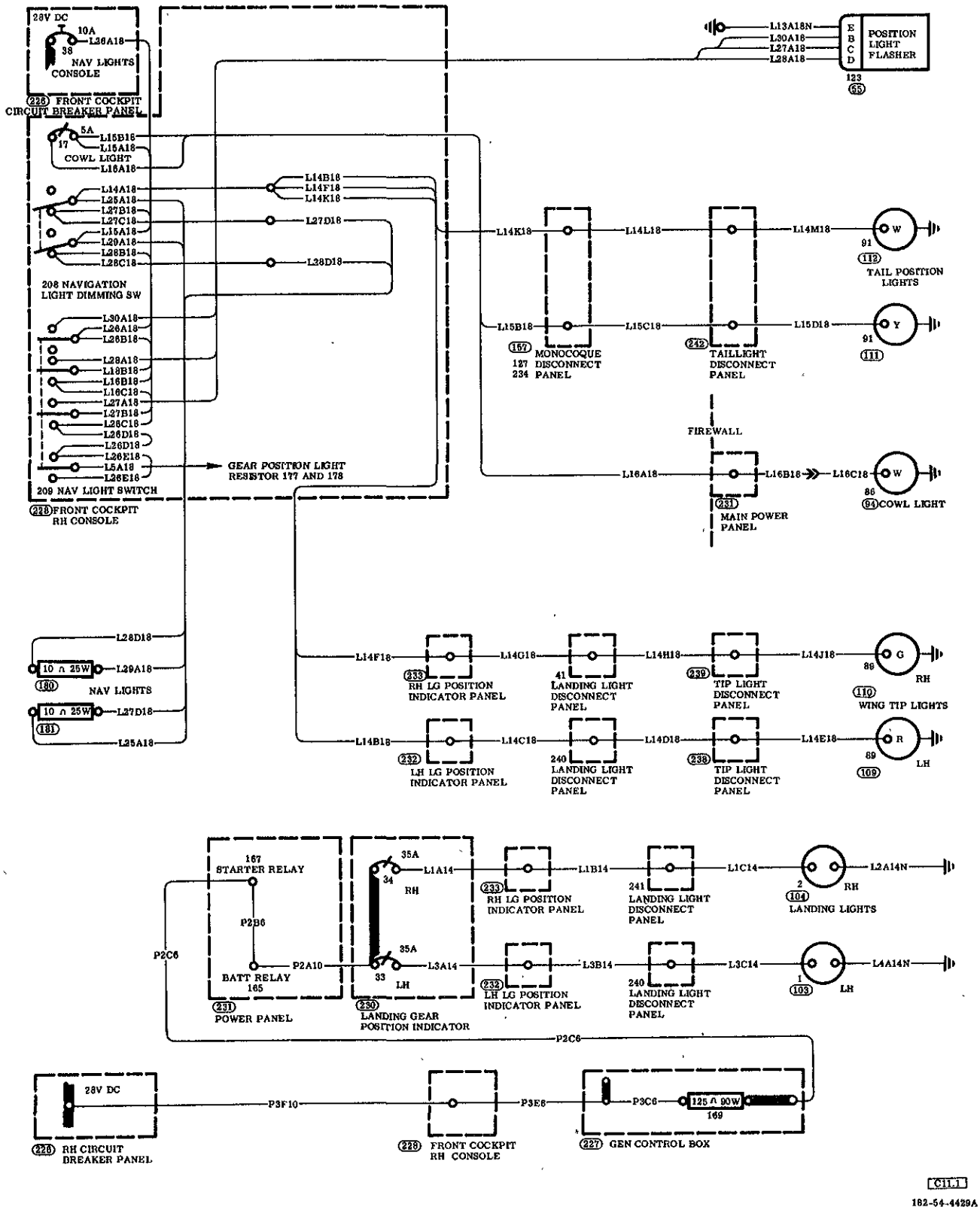
AF50-1277 Through AF50-1326, AF51-15138 Through AF51-15237, and AF51-16071 Through AF51-16077



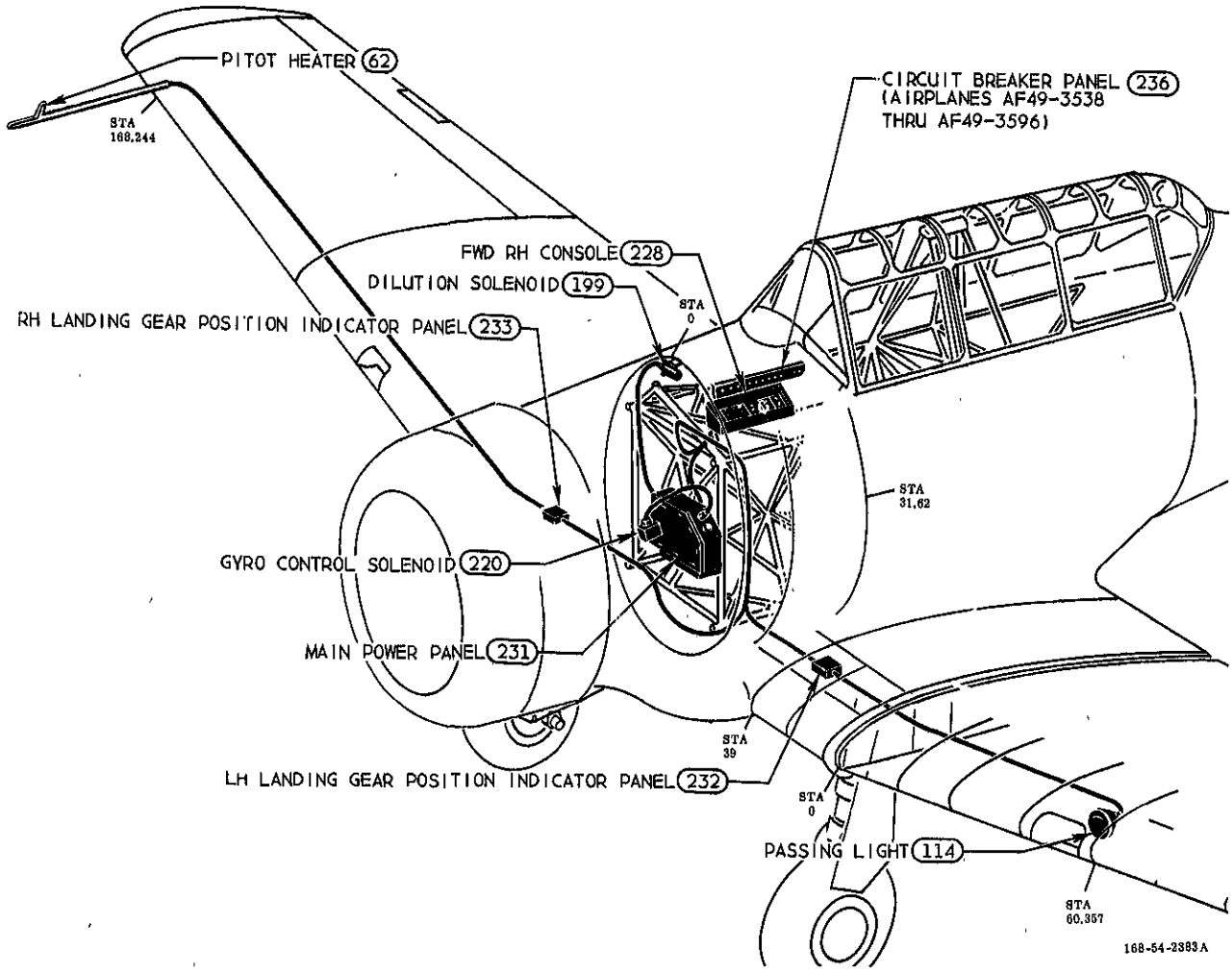
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Adapter - Left-hand Landing Light	CM-1356 (Adams & Westlake)
2	Adapter - Right-hand Landing Light	CM-1356 (Adams & Westlake)
17	Circuit Breaker - Cowl Lights	AN3160-5
33	Circuit Breaker - Left-hand Landing Light	AN3160-35
34	Circuit Breaker - Right-hand Landing Light	AN3160-35
38	Circuit Breaker - Navigation Light	AN3161-P10
55	Flasher - Navigation Light	32260 Type C-2
86	Lamp - Cowl Light	AN3133-311
89	Lamp - Wing Tip Navigation	AN3122-1524
91	Lamp - Tail Position	AN3124-307
94	Light Assembly - Cowl (White)	AN3097-3
103	Light Assembly - Left-hand Landing 450-watt	4541 (General Electric)
104	Light Assembly - Right-hand Landing 450-watt	4541 (General Electric)
109	Light Assembly - Left Wing Navigation (Red)	AN3033-3
110	Light Assembly - Right Wing Navigation (Green)	AN3033-4
111	Light Assembly - Tail Navigation (Yellow)	AN3158-2
112	Light Assembly - Tail Navigation (White)	AN3158-1
123	Plug - Flasher	AN3106A-16S-8S
127	Plug - Monocoque Disconnect	AN3106-20-1S
157	Receptacle - Monocoque Disconnect	AN3100-20-1P

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
165	Relay - Battery	94-32324 Type B-4 (GFP)
167	Relay - Starter	94-32424 Type B-8 (GFP)
169	Resistor - Battery Charging	COABE (Ohmite)
180	Resistor - Navigation Light Dimming	0200B (Ohmite)
181	Resistor - Navigation Light Dimming	0200B (Ohmite)
208	Switch - Navigation Light Dimming	AN3027-2
209	Switch - Navigation Light	AN3227-1
226	Panel - Circuit Breaker	168-54027 (NAA)
227	Control Box - Generator	168-54068 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
230	Box Assembly - Landing Gear Position Indicator	168-33523 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)
232	Panel - Left-hand Landing Gear Position Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)
234	Adapter - Monocoque Disconnect	AN3057-12
238	Disconnect Panel - Left-hand Tip Light	88-54408 (NAA)
239	Disconnect Panel - Right-hand Tip Light	88-54408 (NAA)
240	Disconnect Panel - Left-hand Landing Light	88-54409 (NAA)
241	Disconnect Panel - Right-hand Landing Light	88-54409 (NAA)
242	Disconnect Panel - Taillight	NAS45-8-2

Figure 8-8B. Navigation, Cowl, and Landing Lights - Airplanes

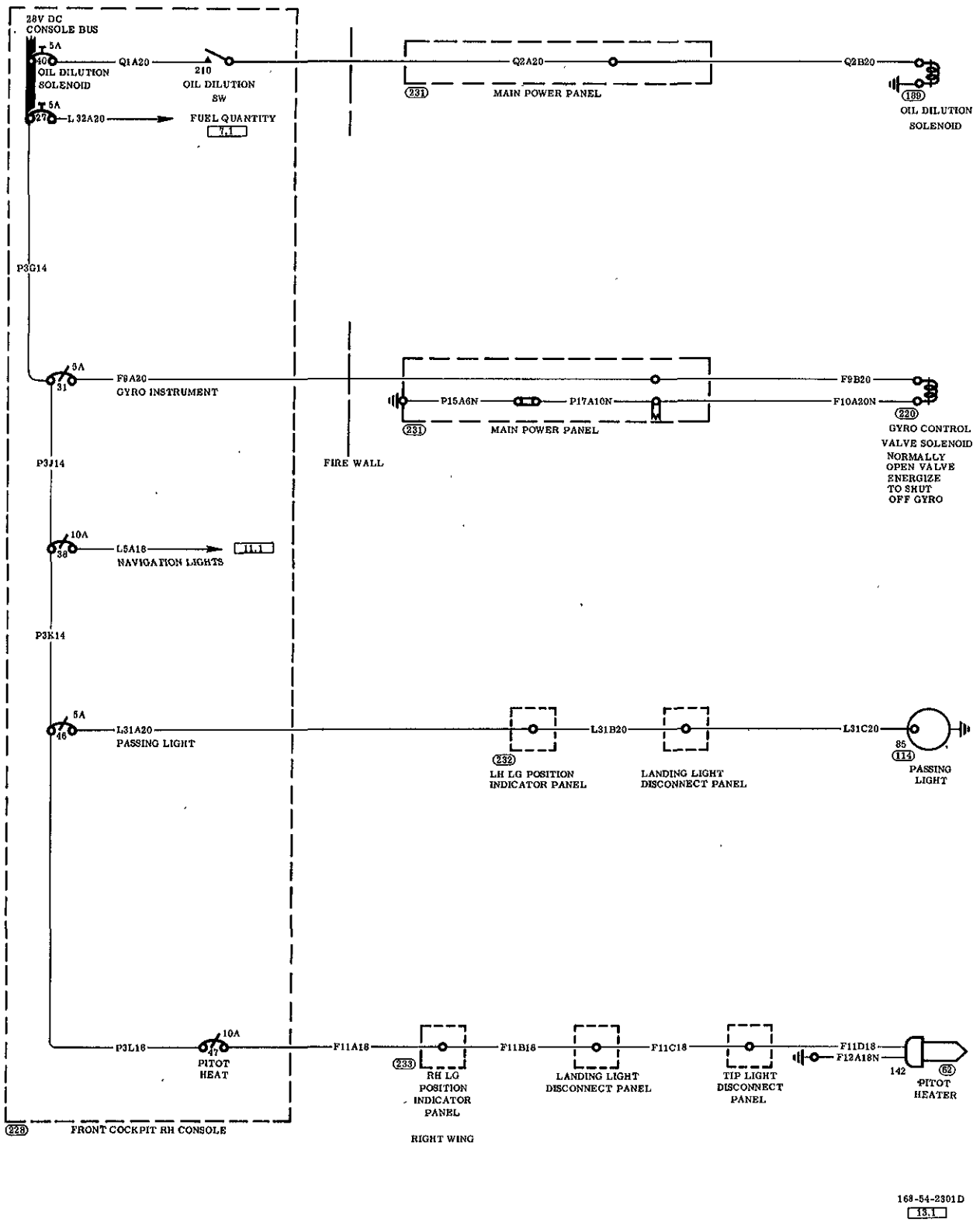


AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent

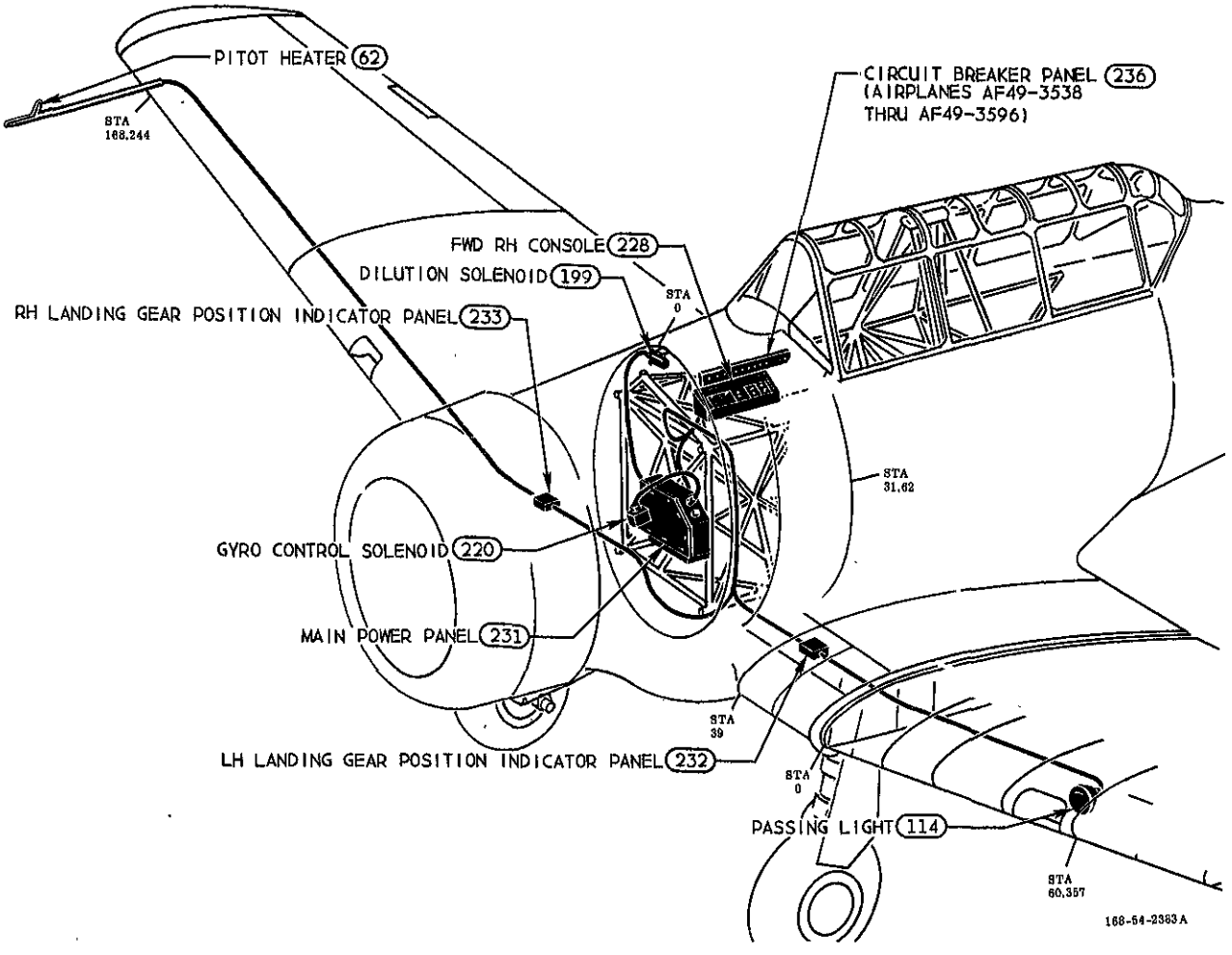


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-P5
38	Circuit Breaker - Navigation Light	AN3160-10
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
46	Circuit Breaker - Passing Light	AN3160-5
47	Circuit Breaker - Pitot Heater	AN3160-10
53	Circuit Breaker - Turn-and-Bank Indicator	AN3160-5
62	Heater - Pitot	94-27876
85	Lamp - Passing Light	RP-11
114	Light Assembly - Passing	37D4865
142	Plug - Pitot Heater	39A3637
189	Solenoid - Oil Dilution	37D6210
210	Switch - Oil Dilution Solenoid	AF37D6210
220	Valve - Gyro Control Solenoid	10171 (Carman)
228	Console - Forward Right-hand	168-54005 (NAA)
231	Panel - Main Power	168-54072 (NAA)
232	Panel - Left-hand Landing Gear Position Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)

Figure 8-9. Oil Dilution, Gyro Control, Passing Light,

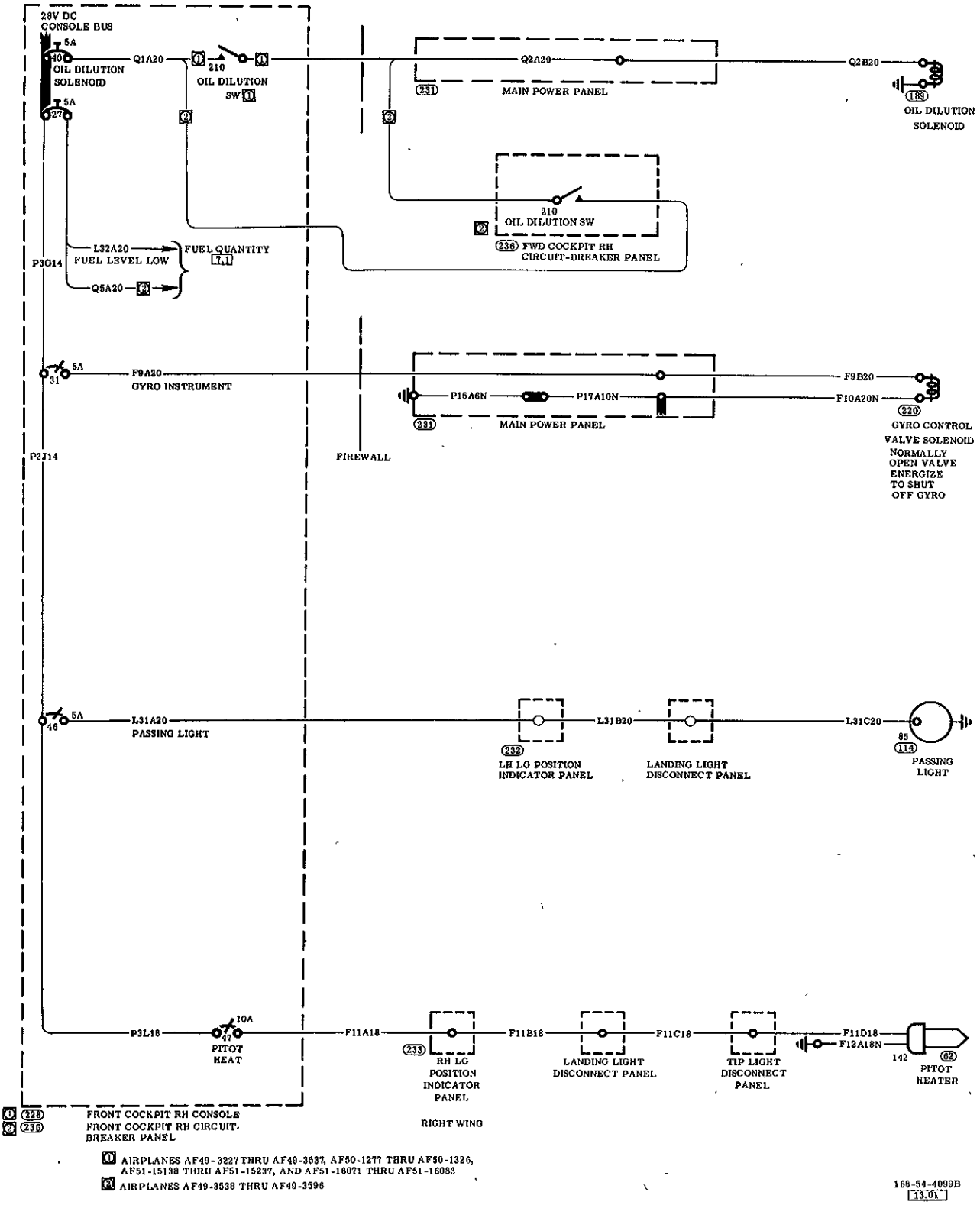


and Pitot Heater - Airplanes AF49-2897 Through AF49-3226



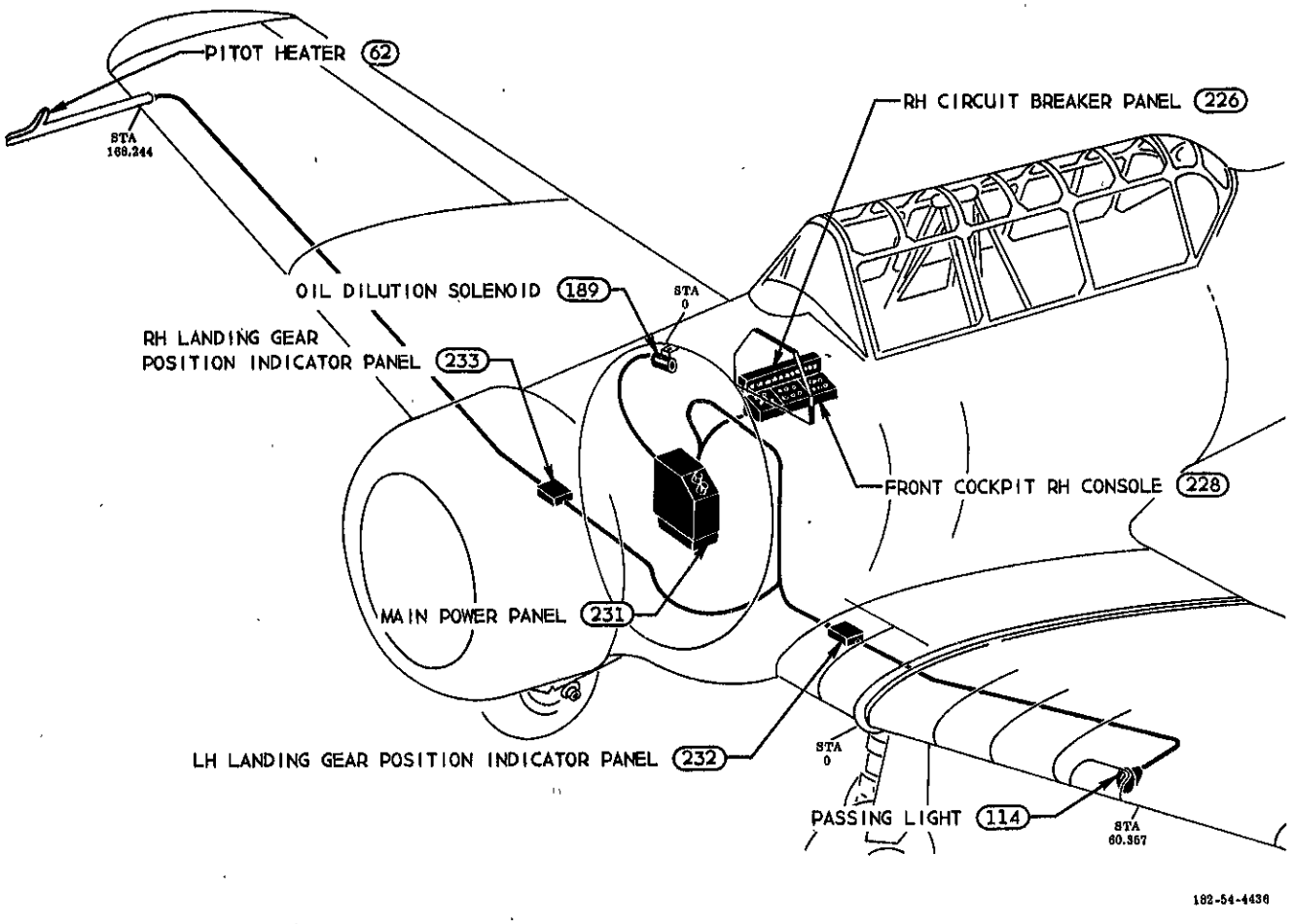
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-P5
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
46	Circuit Breaker - Passing Light	AN3160-5
47	Circuit Breaker - Pitot Heater	AN3160-10
62	Heater - Pitot	94-27876
85	Lamp - Passing Light	RP-11
114	Light Assembly - Passing	37D4865
142	Plug - Pitot Heater	39A3637
189	Solenoid - Oil Dilution	37D6210
210	Switch - Oil Dilution Solenoid	AF37D6210
220	Valve - Gyro Control Solenoid	10171 (Carman)
228	Console - Forward Right-hand	168-54005-20 (NAA)
231	Panel - Main Power	168-54072 (NAA)
232	Panel - Left-hand Landing Gear Position Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)
236	Panel - Right-hand Circuit Breaker	168-54082 (NAA)

Figure 8-9A. Oil Dilution, Gyro Control, Passing Light, and Pitot Heater - AF51-15138 Through AF51-15237,



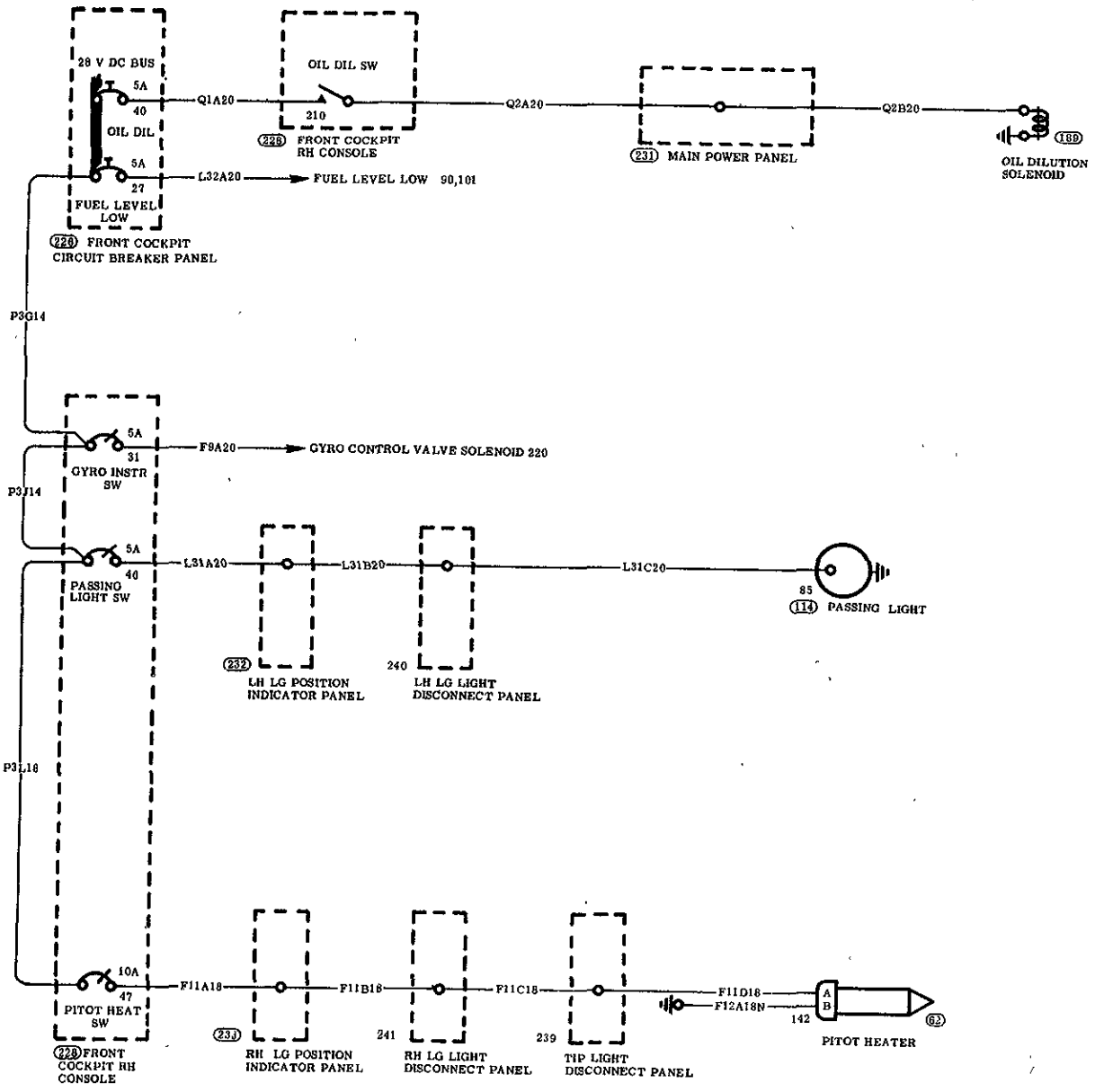
Airplanes AF49-3227 Through AF49-3596, AF50-1277 Through AF50-1326, and AF51-16071 Through AF51-16077

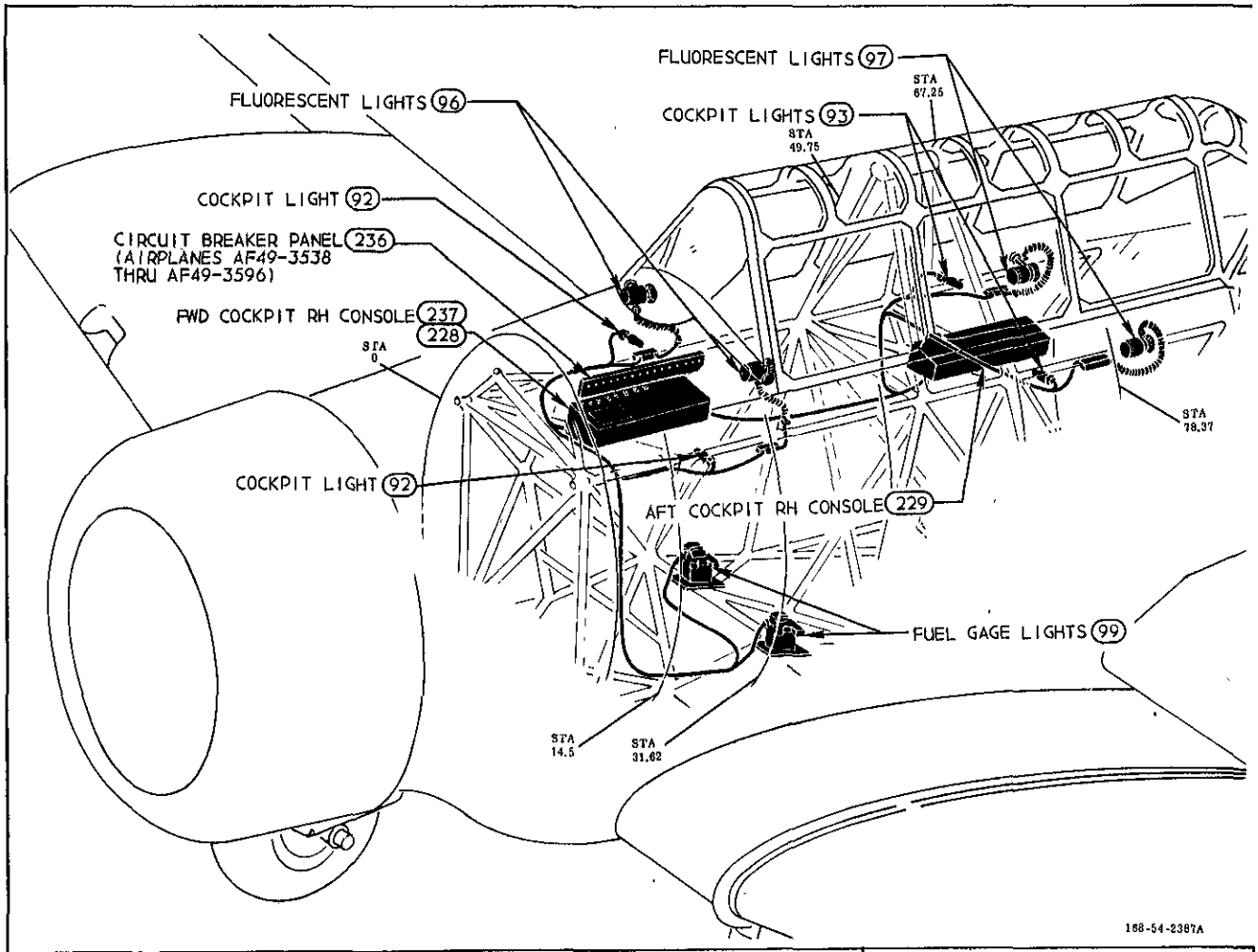
REVISED 15 JULY 1952



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
27	Circuit Breaker - Fuel Low-level Warning Light	AN3161-P5
31	Circuit Breaker - Gyro Control Valve	AN3160-5
40	Circuit Breaker - Oil Dilution Solenoid	AN3161-P5
46	Circuit Breaker - Passing Light	AN3160-5
47	Circuit Breaker - Pitot Heater	AN3160-10
62	Heater - Pitot	Type D-1 (GFP)
85	Lamp - Passing Light	RP-11
114	Light Assembly - Passing	37D4865, Type B-3
142	Plug - Pitot Heater	30A3637 (GFP)
189	Solenoid - Oil Dilution	37D6210
210	Switch - Oil Dilution Solenoid	AN3022-8
226	Panel - Circuit Breaker	182-54027 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)
232	Panel - Left-hand Landing Gear Position Indicator	168-54025-1 (NAA)
233	Panel - Right-hand Landing Gear Position Indicator	168-54025-2 (NAA)
239	Disconnect Panel - Tip Light	88-54408 (NAA)
240	Disconnect Panel - Left-hand Landing Light	88-54409 (NAA)
241	Disconnect Panel - Right-hand Landing Light	88-54409 (NAA)

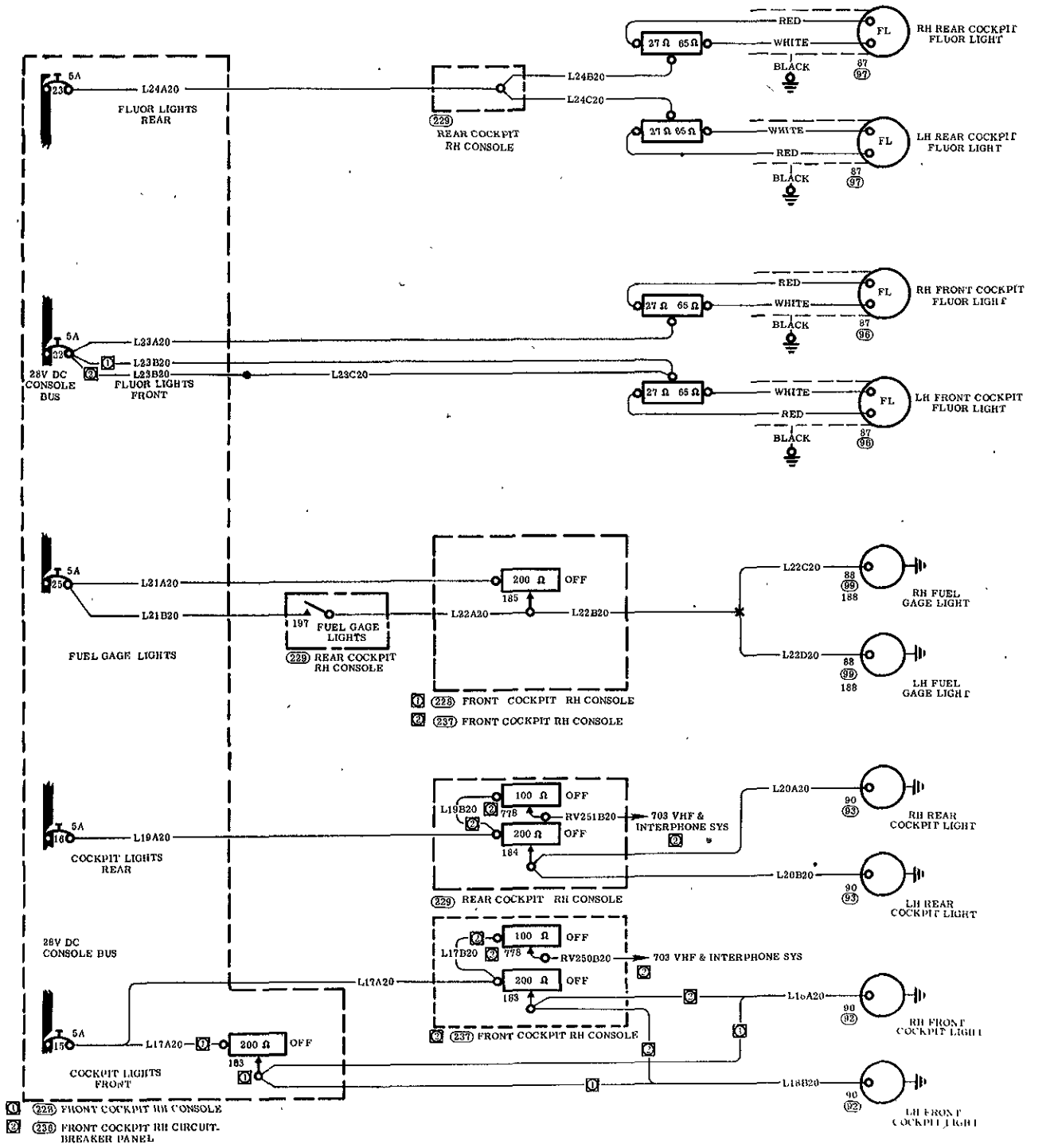
Figure 8-9B. Oil Dilution, Gyro Control, Passing Light, and Pitot Heater -

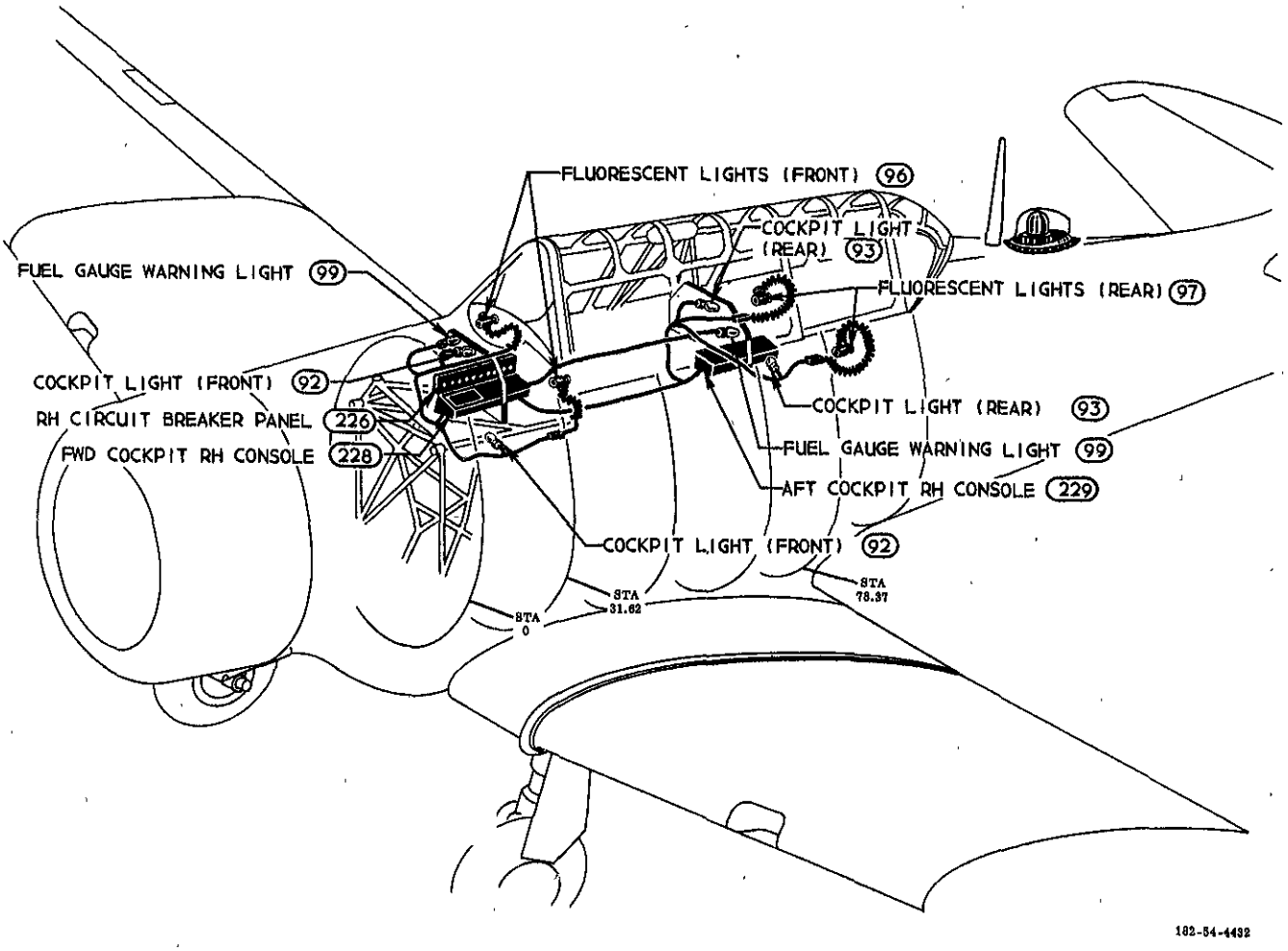

28 V DC BUS
5A
40
OIL DIL
5A
27
FUEL LEVEL LOW
226 FRONT COCKPIT CIRCUIT BREAKER PANEL
Q1A20
OIL DIL SW
210
228 FRONT COCKPIT RH CONSOLE
Q2A20
231 MAIN POWER PANEL
Q2B20
189
OIL DILUTION SOLENOID
L32A20
FUEL LEVEL LOW 90,101
P3G14
5A
31
GYRO INSTR SW
F9A20
GYRO CONTROL VALVE SOLENOID 220
P3J14
5A
40
PASSING LIGHT SW
L31A20
L31B20
L31C20
85
114 PASSING LIGHT
232 LH LG POSITION INDICATOR PANEL
240 LH LG LIGHT DISCONNECT PANEL
P3L18
10A
47
PITOT HEAT SW
F11A18
F11B18
F11C18
F11D18
F12A18N
A
B
142
62
PITOT HEATER
228 FRONT COCKPIT RH CONSOLE
237 RH LG POSITION INDICATOR PANEL
241 RH LG LIGHT DISCONNECT PANEL
239 TIP LIGHT DISCONNECT PANEL
C13.1
182-54-4424



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
15	Circuit Breaker - Lights (Front Cockpit)	AN3161-P5
16	Circuit Breaker - Lights (Rear Cockpit)	AN3161-P5
22	Circuit Breaker - Fluorescent Lights (Front Cockpit)	AN3161-P5
23	Circuit Breaker - Fluorescent Lights (Rear Cockpit)	AN3161-P5
25	Circuit Breaker - Fuel Gage Lights	AN3161-P5
87	Lamp - Fluorescent Lights	AN3125-1
88	Lamp - Bayonet Light	AN3123-301
90	Lamp - Miniature	AN3121-313
92	Light Assembly - Illumination (Front Cockpit)	AN3034-2
93	Light Assembly - Illumination (Rear Cockpit)	AN3034-2
96	Light Assembly - Fluorescent (Front Cockpit)	32451
97	Light Assembly - Fluorescent (Rear Cockpit)	32451
99	Light Assembly - Fuel Gage	25-54052
183	Rheostat - Lights (Front Cockpit)	AN3155-25-200
184	Rheostat - Lights (Rear Cockpit)	AN3155-25-200
185	Rheostat - Fuel Gage Lights	AN3155-25-200
188	Socket - Bayonet Light	31A4527 (H. A. Douglas)
197	Switch - Fuel Gage Lights (Rear Cockpit)	AN3022-8
228	Console - Forward Right-hand	168-54005 (NAA), 168-54005-20 (NAA)
229	Console - Aft Right-hand	168-54006 (NAA), 168-54006-10 (NAA)
236	Panel - Forward Right-hand Circuit Breaker	168-54082 (NAA)

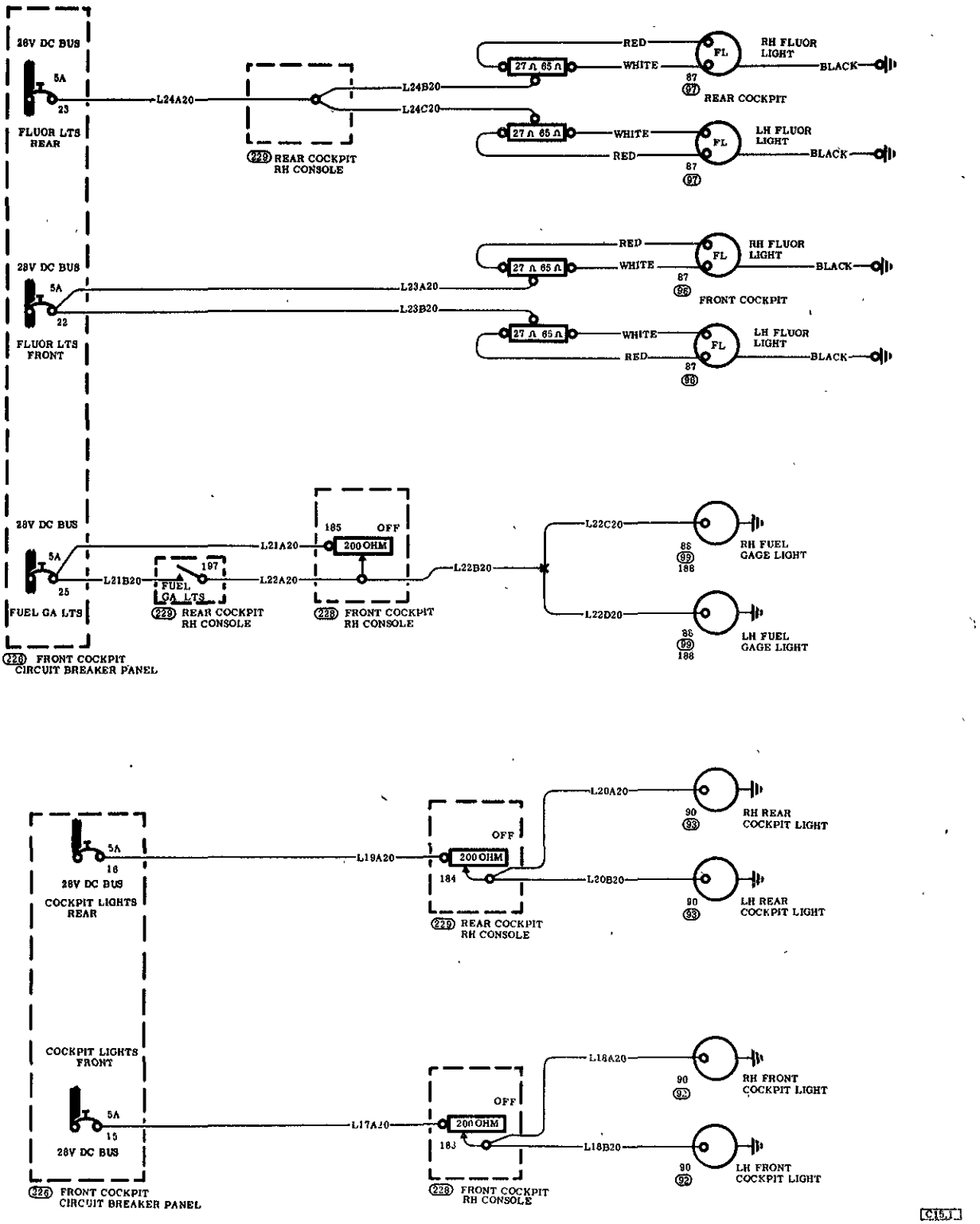
Figure 8-10. Cockpit and Fuel Gage Lights - Airplanes AF49-2897 Through AF49-3596,

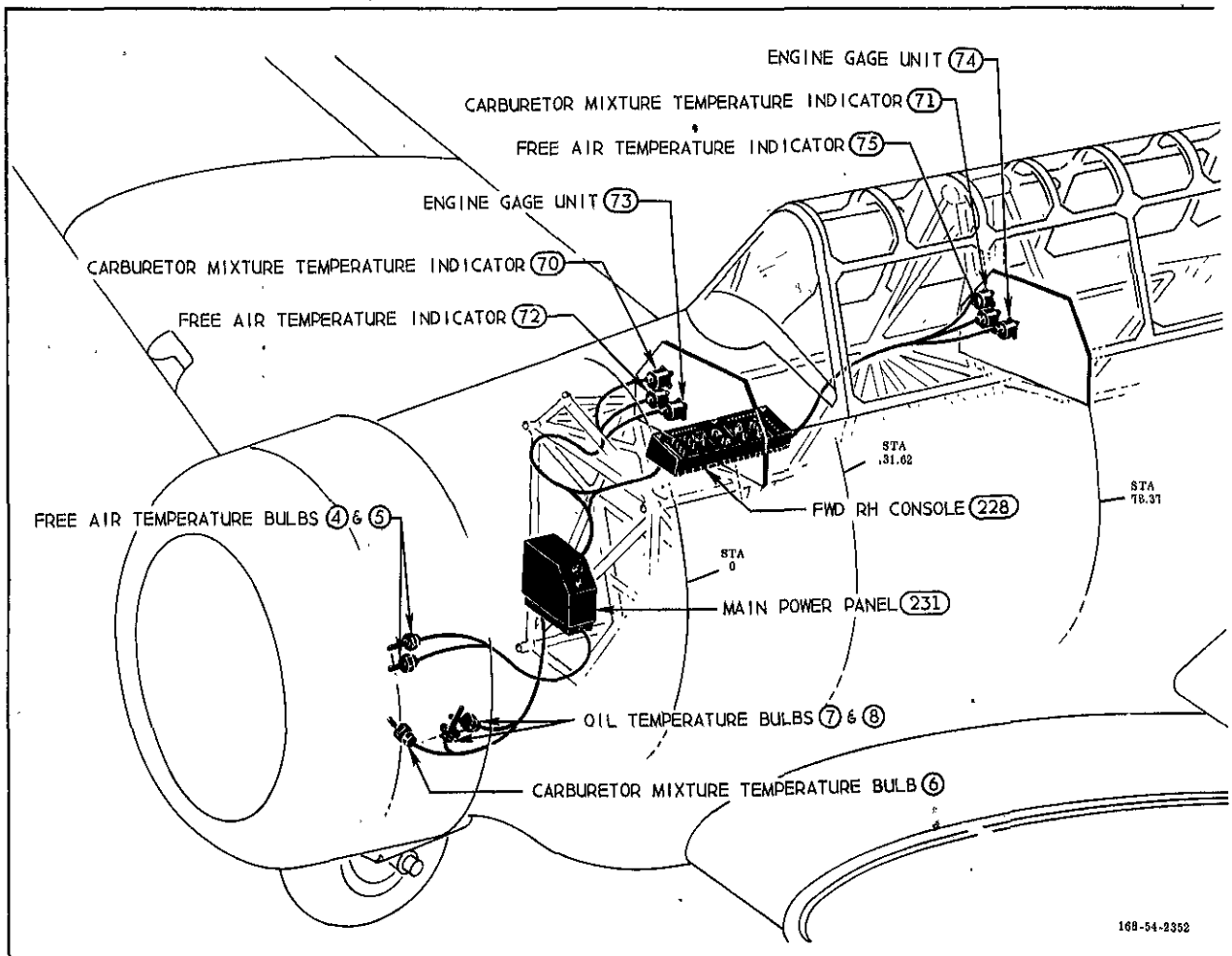

5A
23
L24A20
FLUOR LIGHTS REAR
229
REAR COCKPIT RH CONSOLE
L24B20
L24C20
27 Ω 65 Ω
RED
WHITE
BLACK
FL
RH REAR COCKPIT FLUOR LIGHT
LH REAR COCKPIT FLUOR LIGHT
87
97
5A
22
L23A20
L23B20
L23B20
28V DC CONSOLE BUS
FLUOR LIGHTS FRONT
L23C20
RH FRONT COCKPIT FLUOR LIGHT
LH FRONT COCKPIT FLUOR LIGHT
96
5A
25
L21A20
L21B20
FUEL GAGE LIGHTS
197
FUEL GAGE LIGHTS
229 REAR COCKPIT RH CONSOLE
200 Ω
OFF
185
L22A20
L22B20
L22C20
L22D20
88
99
188
RH FUEL GAGE LIGHT
LH FUEL GAGE LIGHT
228 FRONT COCKPIT RH CONSOLE
237 FRONT COCKPIT RH CONSOLE
5A
16
L19A20
COCKPIT LIGHTS REAR
100 Ω
200 Ω
L19B20
778
RV251B20
703 VHF & INTERPHONE SYS
184
L20A20
L20B20
90
93
RH REAR COCKPIT LIGHT
LH REAR COCKPIT LIGHT
229 REAR COCKPIT RH CONSOLE
28V DC CONSOLE BUS
L17B20
RV250B20
703 VHF & INTERPHONE SYS
183
L17A20
L16A20
L18B20
92
RH FRONT COCKPIT LIGHT
LH FRONT COCKPIT LIGHT
237 FRONT COCKPIT RH CONSOLE
5A
15
L17A20
COCKPIT LIGHTS FRONT
228 FRONT COCKPIT RH CONSOLE
236 FRONT COCKPIT RH CIRCUIT-BREAKER PANEL
AIRPLANES AF49-2897 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16083
AIRPLANES AF49-3538 THRU AF49-3596



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
15	Circuit Breaker - Lights (Front Cockpit)	AN3161-P5
16	Circuit Breaker - Lights (Rear Cockpit)	AN3161-P5
22	Circuit Breaker - Fluorescent Lights (Front Cockpit)	AN3161-P5
23	Circuit Breaker - Fluorescent Lights (Rear Cockpit)	AN3161-P5
25	Circuit Breaker - Fuel Gage Lights	AN3161-P5
87	Lamp - Fluorescent Lights	AN3125-1
88	Lamp - Fuel Gage Lights	AN3123-301
90	Lamp - Miniature	AN3121-313
92	Light Assembly - Illumination (Front Cockpit)	AN3034-2
93	Light Assembly - Illumination (Rear Cockpit)	AN3034-2
96	Light Assembly - Fluorescent (Front Cockpit)	32451, Type C-8
97	Light Assembly - Fluorescent (Rear Cockpit)	32451, Type C-8
99	Light Assembly - Fuel Gage	25-54052
183	Rheostat - Lights (Front Cockpit)	AN3155-25-200
184	Rheostat - Lights (Rear Cockpit)	AN3155-25-200
185	Rheostat - Fuel Gage Lights	AN3155-25-200
188	Socket - Fuel Gage Light Assembly	31A4527 (H.A. Douglas)
197	Switch - Fuel Gage Lights (Rear Cockpit)	AN3022-8
226	Panel - Circuit Breaker	182-54-27 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
229	Console Assembly - Electric and Radio (Rear Cockpit)	168-54006-10 (NAA)

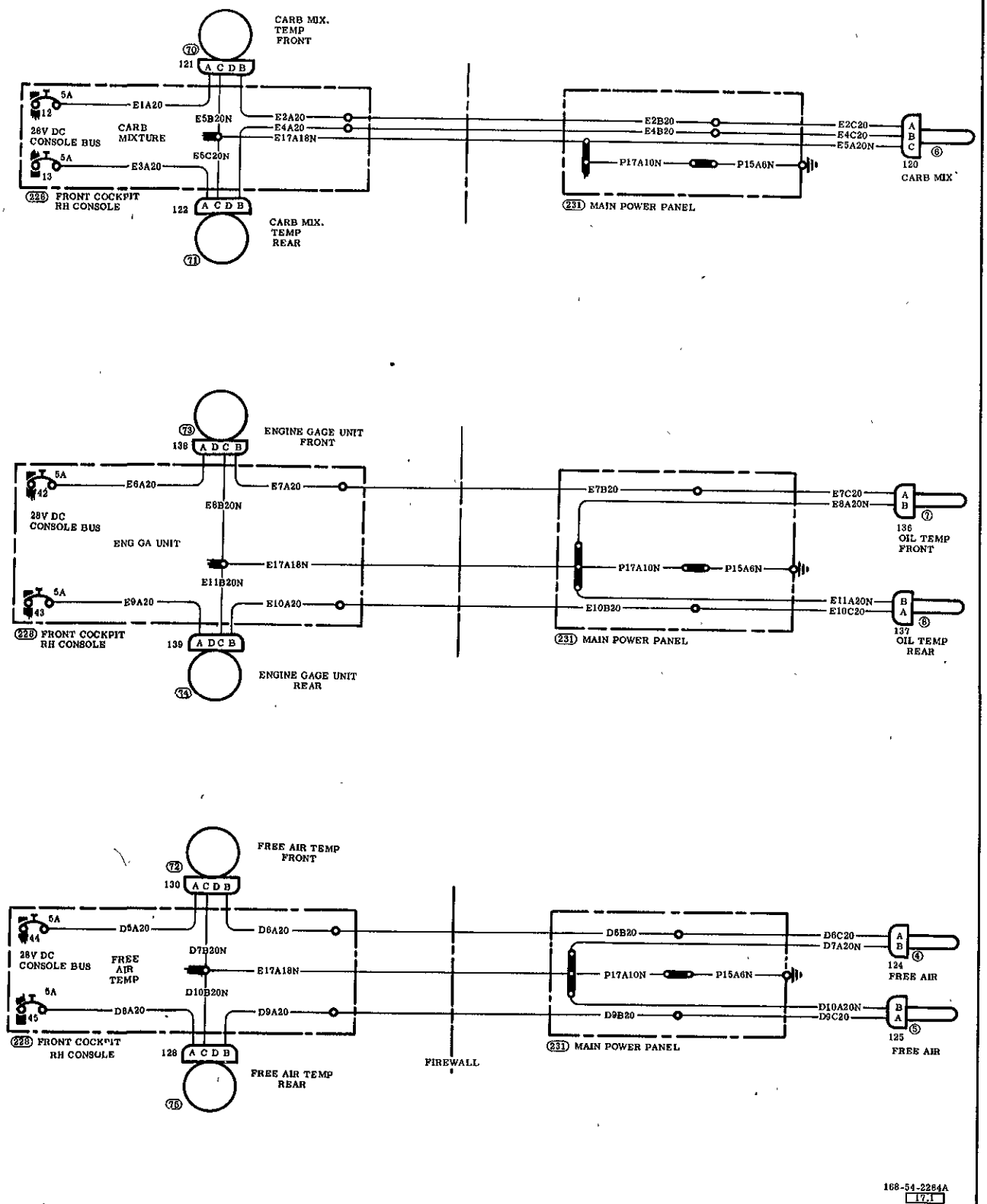
Figure 8-10A. Cockpit and Fuel Gage Lights - Airplanes


28V DC BUS
5A
23
FLUOR LTS REAR
L24A20
(229) REAR COCKPIT RH CONSOLE
L24B20
L24C20
27 Ω 65 Ω
RED
WHITE
FL
87
(97)
RH FLUOR LIGHT
BLACK
REAR COCKPIT
LH FLUOR LIGHT
28V DC BUS
5A
22
FLUOR LTS FRONT
L23A20
L23B20
(96)
FRONT COCKPIT
28V DC BUS
5A
25
FUEL GA LTS
L21A20
L21B20
197
FUEL GA LTS
L22A20
185
OFF
200 OHM
L22B20
L22C20
L22D20
(228) FRONT COCKPIT CIRCUIT BREAKER PANEL
(229) REAR COCKPIT RH CONSOLE
(228) FRONT COCKPIT RH CONSOLE
86
(99)
188
RH FUEL GAGE LIGHT
LH FUEL GAGE LIGHT
5A
16
28V DC BUS
COCKPIT LIGHTS REAR
L19A20
OFF
200 OHM
184
L20A20
L20B20
(229) REAR COCKPIT RH CONSOLE
90
(93)
RH REAR COCKPIT LIGHT
LH REAR COCKPIT LIGHT
COCKPIT LIGHTS FRONT
5A
15
28V DC BUS
L17A20
183
L18A20
L18B20
(92)
RH FRONT COCKPIT LIGHT
LH FRONT COCKPIT LIGHT
(226) FRONT COCKPIT CIRCUIT BREAKER PANEL
(228) FRONT COCKPIT RH CONSOLE
C15J
182-54-4423



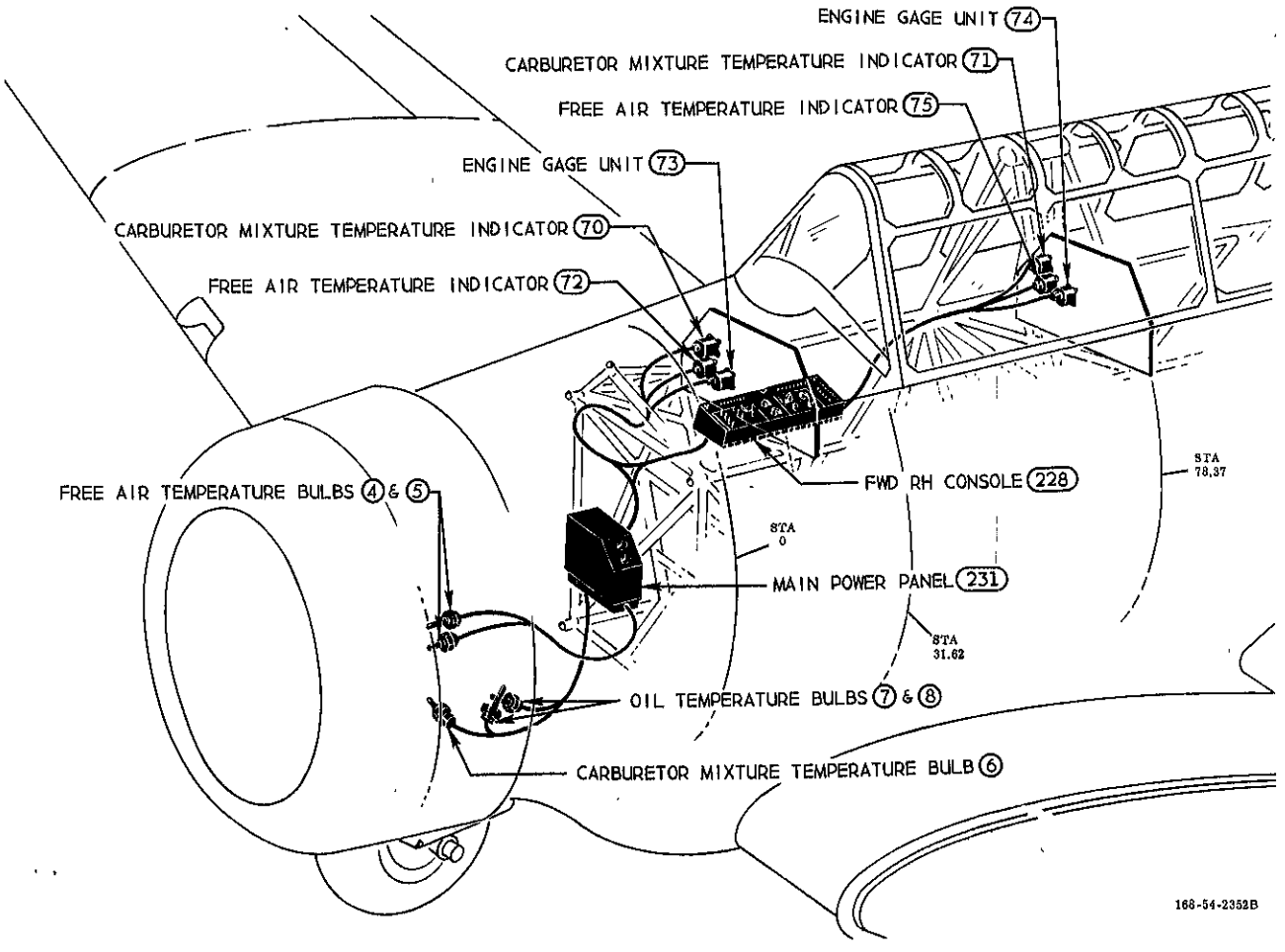
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
4	Bulb - Free Air Temperature (Front Cockpit)	AN5525-1
5	Bulb - Free Air Temperature (Rear Cockpit)	AN5525-1
6	Bulb - Carburetor Mixture Dual Element	174ND90 (Edison)
7	Bulb - Oil Temperature (Front Cockpit)	AN5525-1
8	Bulb - Oil Temperature (Rear Cockpit)	AN5525-1
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
44	Circuit Breaker - Free Air Temperature (Front Cockpit)	AN3161-P5
45	Circuit Breaker - Free Air Temperature (Rear Cockpit)	AN3161-P5
70	Indicator - Carburetor Mixture (Front Cockpit)	AN5790-6
71	Indicator - Carburetor Mixture (Rear Cockpit)	AN5790-6
72	Indicator - Free Air Temperature (Front Cockpit)	AN5790-6
73	Indicator - Engine Gage Unit (Front Cockpit)	AN5773-1
74	Indicator - Engine Gage Unit (Rear Cockpit)	AN5773-1
75	Indicator - Free Air Temperature (Rear Cockpit)	AN5790-6
120	Plug - Carburetor Mixture Bulb	AN3106-14S-7S
121	Plug - Carburetor Mixture Indicator (Front Cockpit)	AN3106-14S-2S
122	Plug - Carburetor Mixture Indicator (Rear Cockpit)	AN3106-14S-2S
124	Plug - Free Air Temperature Bulb (Front Cockpit)	AN3106-12S-3S
125	Plug - Free Air Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
128	Plug - Free Air Temperature Indicator (Rear Cockpit)	AN3106-14S-2S
130	Plug - Free Air Temperature Indicator (Front Cockpit)	AN3106-14S-2S
136	Plug - Oil Temperature Bulb (Front Cockpit)	AN3106-12S-3S
137	Plug - Oil Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
138	Plug - Engine Gage Unit (Front Cockpit)	AN3106-14S-2S
139	Plug - Engine Gage Unit (Rear Cockpit)	AN3106-14S-2S
228	Console - Forward Right-hand	168-54005 (NAA)
231	Panel - Main Power	168-54072 (NAA)

Figure 8-11. Carburetor Mixture, Oil, and Free Air Temperature



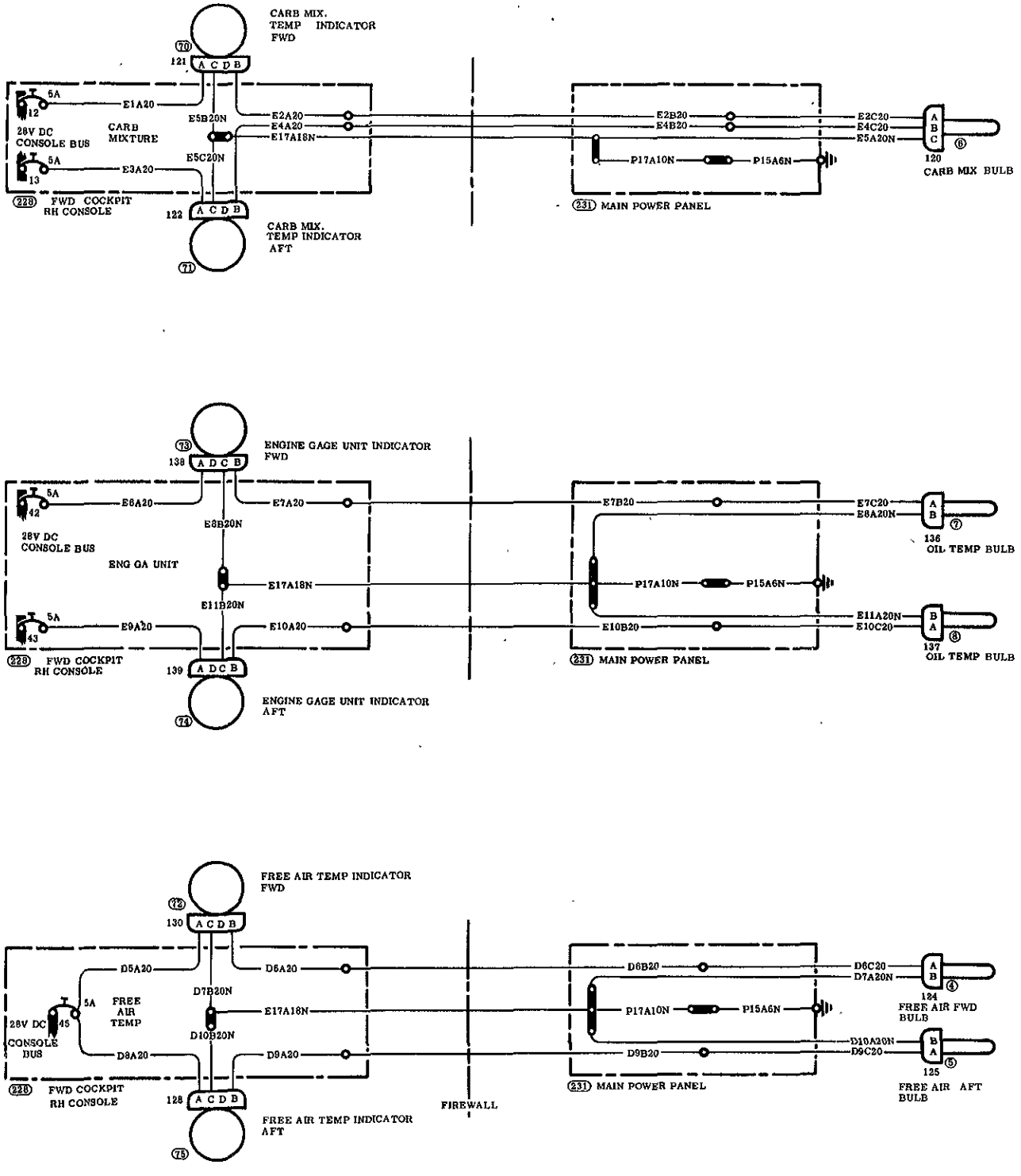
Indicators - Airplanes AF49-2897 Through AF49-3226

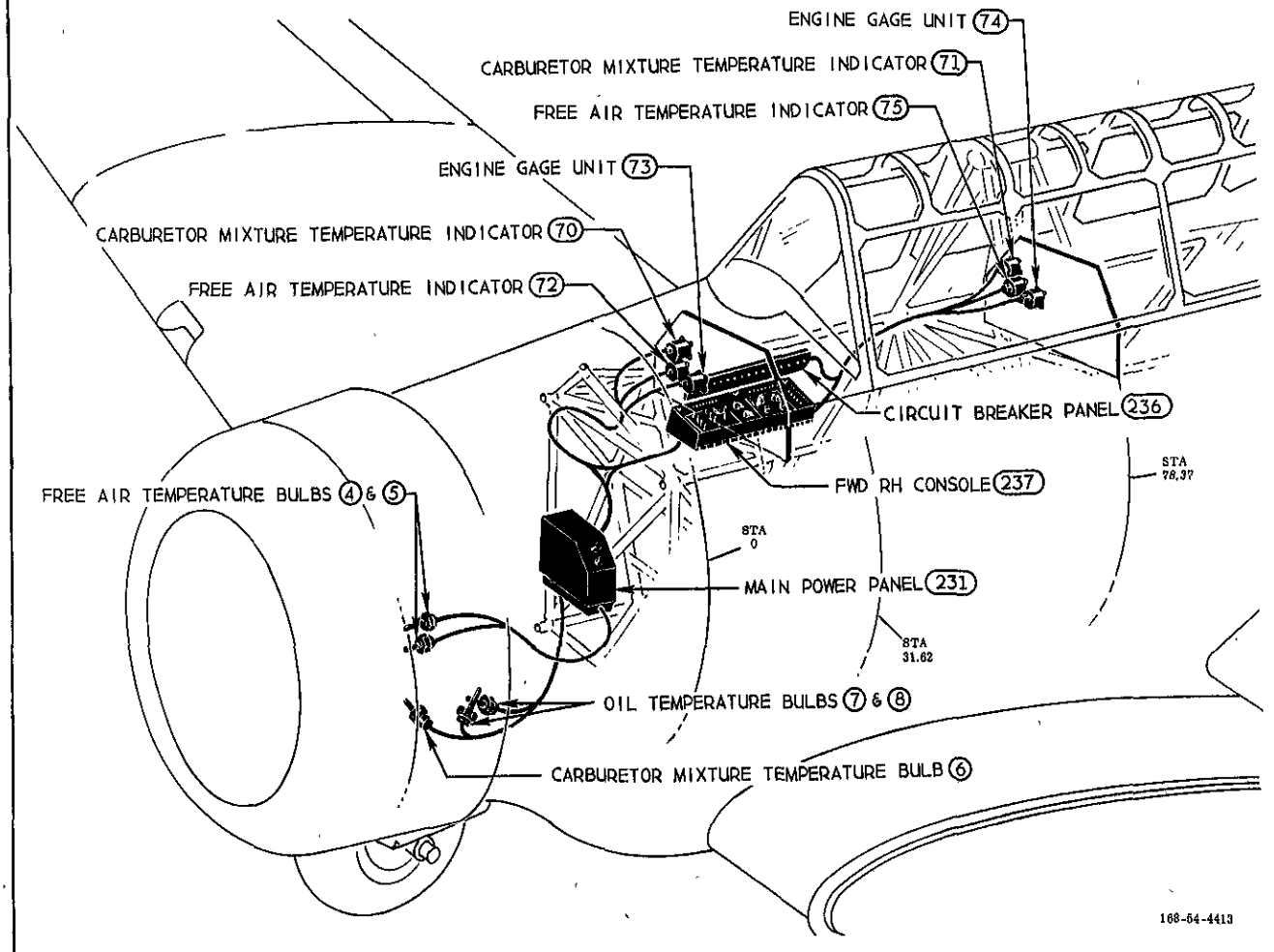
REVISED 10 APRIL 1951



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
4	Bulb - Free Air Temperature (Front Cockpit)	AN AN5525-1
5	Bulb - Free Air Temperature (Rear Cockpit)	AN5525-1
6	Bulb - Carburetor Mixture Dual Element	174ND90 (Edison)
7	Bulb - Oil Temperature (Front Cockpit)	AN5525-1
8	Bulb - Oil Temperature (Rear Cockpit)	AN5525-1
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
45	Circuit Breaker - Free Air Temperature (Rear Cockpit)	AN3161-P5
70	Indicator - Carburetor Mixture (Front Cockpit)	AN5790-6
71	Indicator - Carburetor Mixture (Rear Cockpit)	AN5790-6
72	Indicator - Free Air Temperature (Front Cockpit)	AN5790-6
73	Indicator - Engine Gage Unit (Front Cockpit)	AN5773-1
74	Indicator - Engine Gage Unit (Rear Cockpit)	AN5773-1
75	Indicator - Free Air Temperature (Rear Cockpit)	AN5790-6
120	Plug - Carburetor Mixture Bulb	AN3106-14S-7S
121	Plug - Carburetor Mixture Indicator (Front Cockpit)	AN3106-14S-2S
122	Plug - Carburetor Mixture Indicator (Rear Cockpit)	AN3106-14S-2S
124	Plug - Free Air Temperature Bulb (Front Cockpit)	AN3106-12S-3S
125	Plug - Free Air Temperature (Rear Cockpit)	AN3106-12S-3S
128	Plug - Free Air Temperature Indicator (Rear Cockpit)	AN3106-14S-2S
130	Plug - Free Air Temperature Indicator (Front Cockpit)	AN3106-14S-2S
136	Plug - Oil Temperature Bulb (Front Cockpit)	AN3106-12S-3S
137	Plug - Oil Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
138	Plug - Engine Gage Unit (Front Cockpit)	AN3106-14S-2S
139	Plug - Engine Gage Unit (Rear Cockpit)	AN3106-14S-2S
228	Console - Forward Right-hand	168-54005-20 (NAA)
231	Panel - Main Power	168-54072 (NAA)

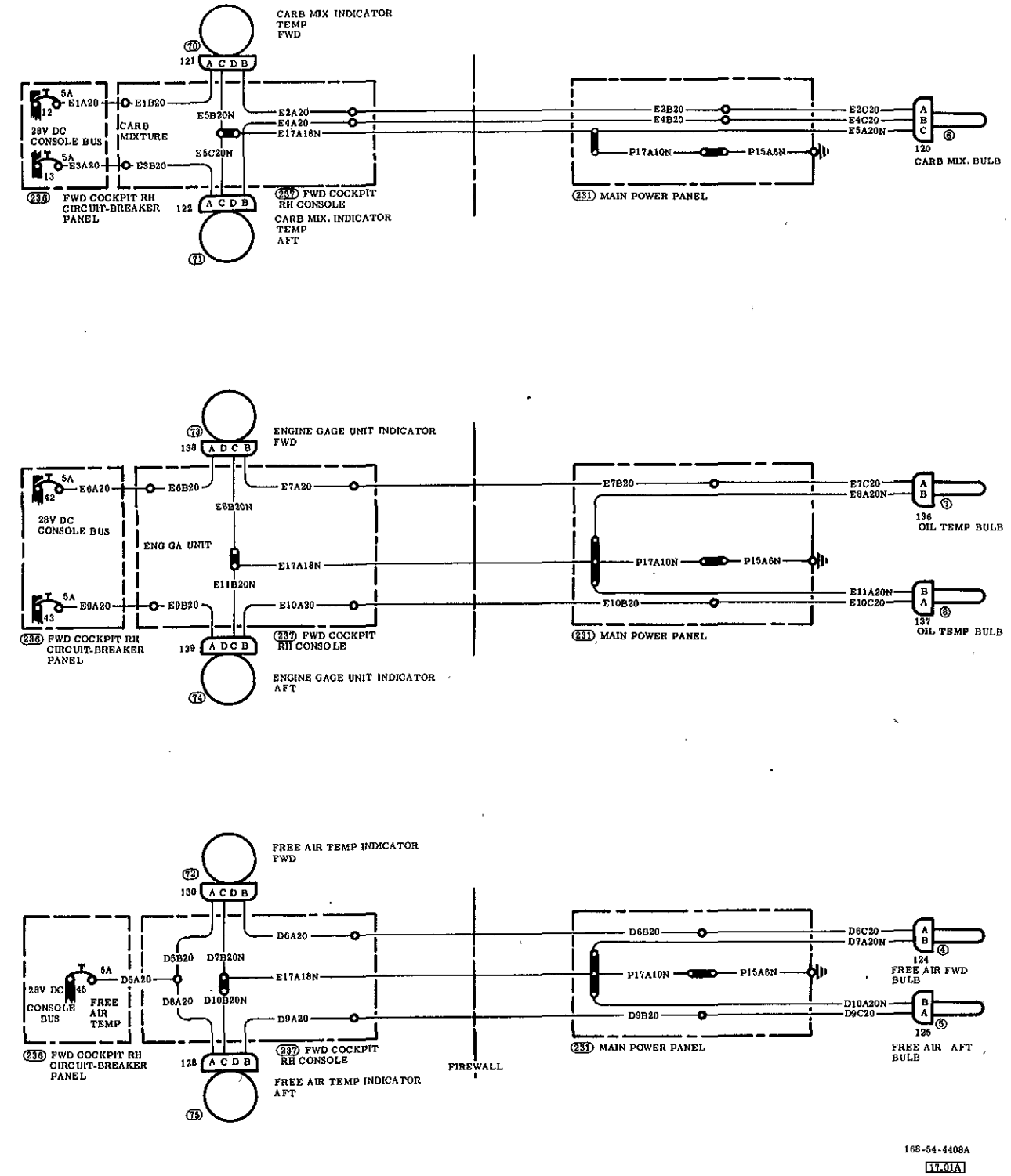
Figure 8-11A. Carburetor Mixture, Oil, and Free Air Temperature Indicators - AF51-15138 Through AF51-15237, and

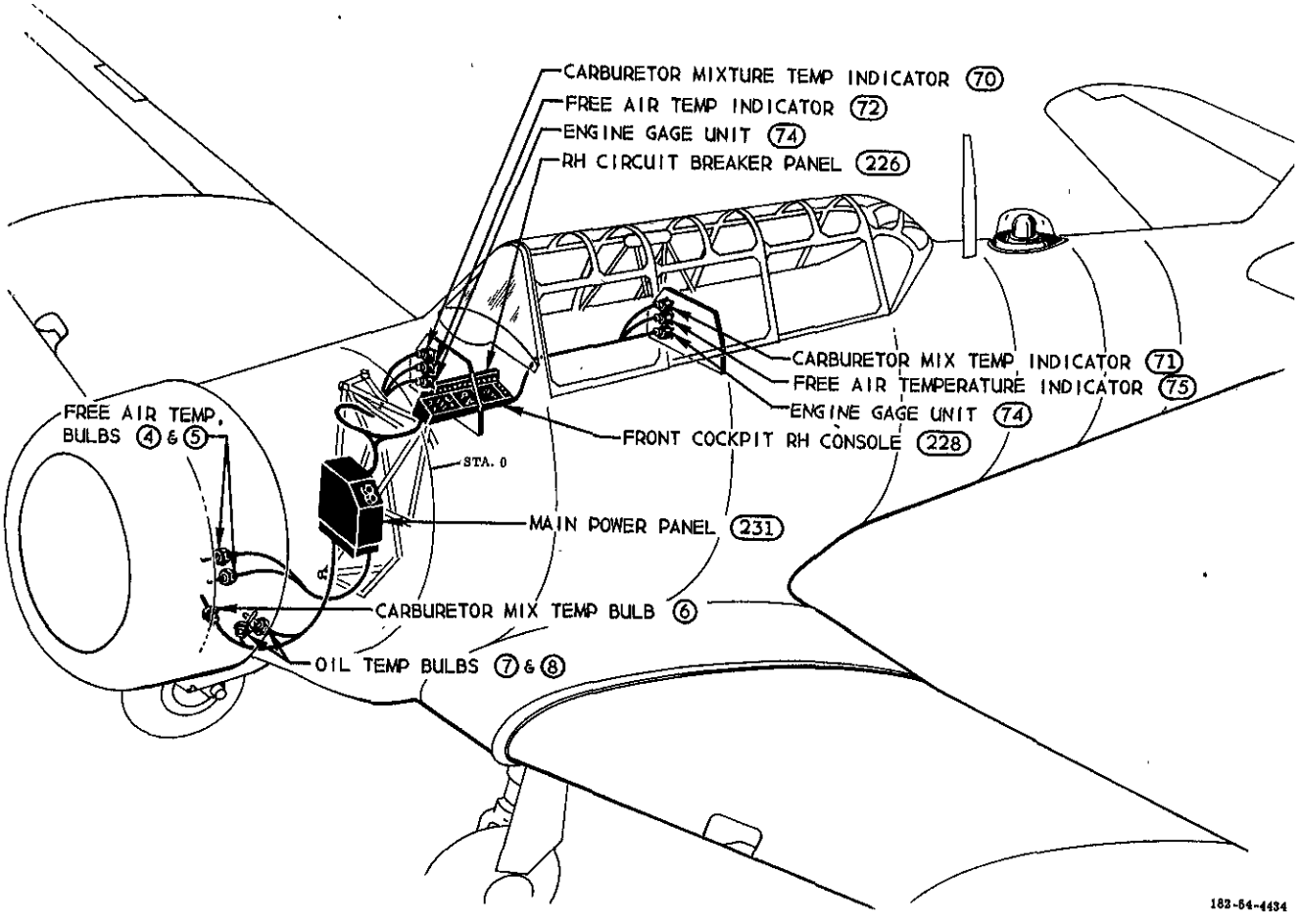

CARB MIX. TEMP INDICATOR FWD
70
121
A C D B
5A
12
E1A20
28V DC CONSOLE BUS
CARB MIXTURE
E5B20N
E2A20
E4A20
E17A18N
E2B20
E4B20
E2C20
E4C20
E5A20N
A B C
6
120
CARB MIX BULB
5A
13
E3A20
E5C20N
P17A10N
P15A6N
228 FWD COCKPIT RH CONSOLE
122
A C D B
CARB MIX. TEMP INDICATOR AFT
71
231 MAIN POWER PANEL
73
ENGINE GAGE UNIT INDICATOR FWD
138
A D C B
5A
42
E6A20
E7A20
E8B20N
E7B20
E7C20
E8A20N
A B
7
136
OIL TEMP BULB
28V DC CONSOLE BUS
ENG GA UNIT
E17A18N
E11B20N
P17A10N
P15A6N
5A
43
E9A20
E10A20
E11A20N
E10C20
B A
8
137
OIL TEMP BULB
E10B20
228 FWD COCKPIT RH CONSOLE
139
A D C B
ENGINE GAGE UNIT INDICATOR AFT
74
231 MAIN POWER PANEL
72
FREE AIR TEMP INDICATOR FWD
130
A C D B
D5A20
D5A20
D7B20N
D6B20
D6C20
D7A20N
A B
4
124
FREE AIR FWD BULB
5A
FREE AIR TEMP
E17A18N
P17A10N
P15A6N
28V DC
45
CONSOLE BUS
D10B20N
D10A20N
D9C20
B A
5
125
FREE AIR AFT BULB
D8A20
D9A20
D9B20
228 FWD COCKPIT RH CONSOLE
128
A C D B
FREE AIR TEMP INDICATOR AFT
75
231 MAIN POWER PANEL
FIREWALL
168-54-4100D
17.01



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
4	Bulb - Free Air Temperature (Front Cockpit)	AN5525-1
5	Bulb - Free Air Temperature (Rear Cockpit)	AN5525-1
6	Bulb - Carburetor Mixture Dual Element	174ND90 (Edison)
7	Bulb - Oil Temperature (Front Cockpit)	AN5525-1
8	Bulb - Oil Temperature (Rear Cockpit)	AN5525-1
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
45	*Circuit Breaker - Free Air Temperature* (Rear Cockpit)	AN3161-P5
70	Indicator - Carburetor Mixture (Front Cockpit)	AN5790-6
71	Indicator - Carburetor Mixture (Rear Cockpit)	AN5790-6
72	Indicator - Free Air Temperature (Front Cockpit)	AN5790-6
73	Indicator - Engine Gage Unit (Front Cockpit)	AN5773-1
74	Indicator - Engine Gage Unit (Rear Cockpit)	AN5773-1
75	Indicator - Free Air Temperature (Rear Cockpit)	AN5790-6
120	Plug - Carburetor Mixture Bulb	AN3106-14S-7S
121	Plug - Carburetor Mixture Indicator (Front Cockpit)	AN3106-14S-2S
122	Plug - Carburetor Mixture Indicator (Rear Cockpit)	AN3106-14S-2S
124	Plug - Free Air Temperature Bulb (Front Cockpit)	AN3106-12S-3S
125	Plug - Free Air Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
128	Plug - Free Air Temperature Indicator (Rear Cockpit)	AN3106-14S-2S
130	Plug - Free Air Temperature Indicator (Front Cockpit)	AN3106-14S-2S
136	Plug - Oil Temperature Bulb (Front Cockpit)	AN3106-12S-3S
137	Plug - Oil Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
138	Plug - Engine Gage Unit (Front Cockpit)	AN3106-14S-2S
139	Plug - Engine Gage Unit (Rear Cockpit)	AN3106-14S-2S
231	Panel - Main Power	168-54072 (NAA)
236	Panel - Forward Right-hand Circuit Breaker	168-54062 (NAA)
237	*Console - Forward Right-hand*	168-54063

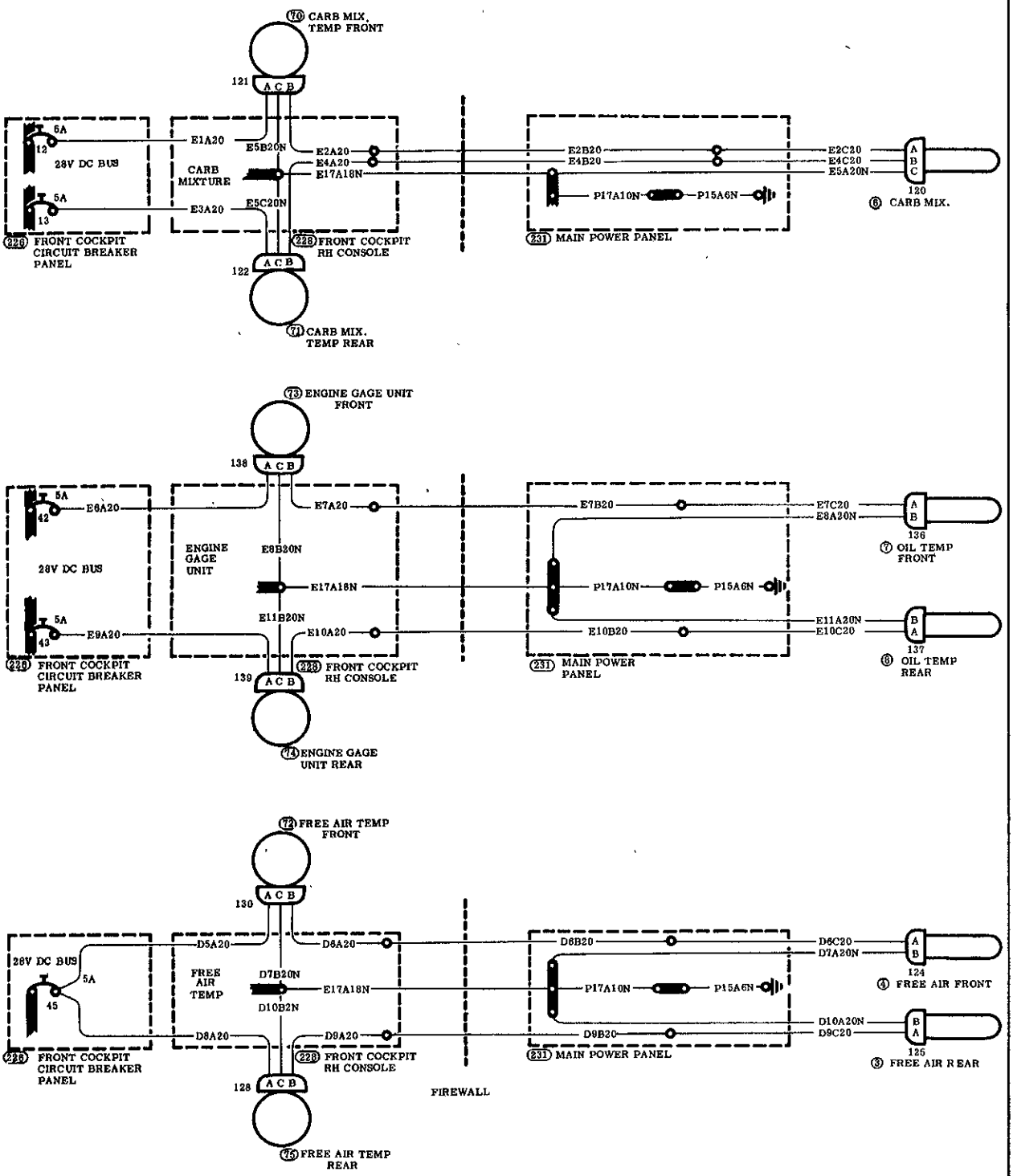
Figure 8-11B. Carburetor Mixture, Oil, and Free Air Temperature


CARB MIX INDICATOR TEMP FWD
70
121
A C D B
5A
12
E1A20
E1B20
28V DC CONSOLE BUS
CARB MIXTURE
E5B20N
E2A20
E4A20
E17A16N
E5C20N
5A
13
E3A20
E3B20
236 FWD COCKPIT RH CIRCUIT-BREAKER PANEL
122
A C D B
237 FWD COCKPIT RH CONSOLE
CARB MIX. INDICATOR TEMP AFT
71
E2B20
E4B20
P17A10N
P15A6N
231 MAIN POWER PANEL
E2C20
E4C20
E5A20N
A B C
6
120
CARB MIX. BULB
ENGINE GAGE UNIT INDICATOR FWD
73
138
A D C B
5A
42
E6A20
E6B20
E7A20
E8B20N
28V DC CONSOLE BUS
ENG GA UNIT
E17A18N
E11B20N
5A
43
E9A20
E9B20
E10A20
236 FWD COCKPIT RH CIRCUIT-BREAKER PANEL
139
A D C B
237 FWD COCKPIT RH CONSOLE
ENGINE GAGE UNIT INDICATOR AFT
74
E7B20
E10B20
P17A10N
P15A6N
231 MAIN POWER PANEL
E7C20
E8A20N
B A
1
136
OIL TEMP BULB
E11A20N
E10C20
B A
8
137
OIL TEMP BULB
FREE AIR TEMP INDICATOR FWD
72
130
A C D B
D6A20
D5B20
D7B20N
5A
45
D5A20
E17A18N
28V DC CONSOLE BUS
FREE AIR TEMP
D8A20
D10B20N
D9A20
236 FWD COCKPIT RH CIRCUIT-BREAKER PANEL
128
A C D B
237 FWD COCKPIT RH CONSOLE
FREE AIR TEMP INDICATOR AFT
75
FIREWALL
D6B20
P17A10N
P15A6N
D9B20
231 MAIN POWER PANEL
D6C20
D7A20N
A B
4
124
FREE AIR FWD BULB
D10A20N
D9C20
B A
5
125
FREE AIR AFT BULB
168-54-4408A
17.01A

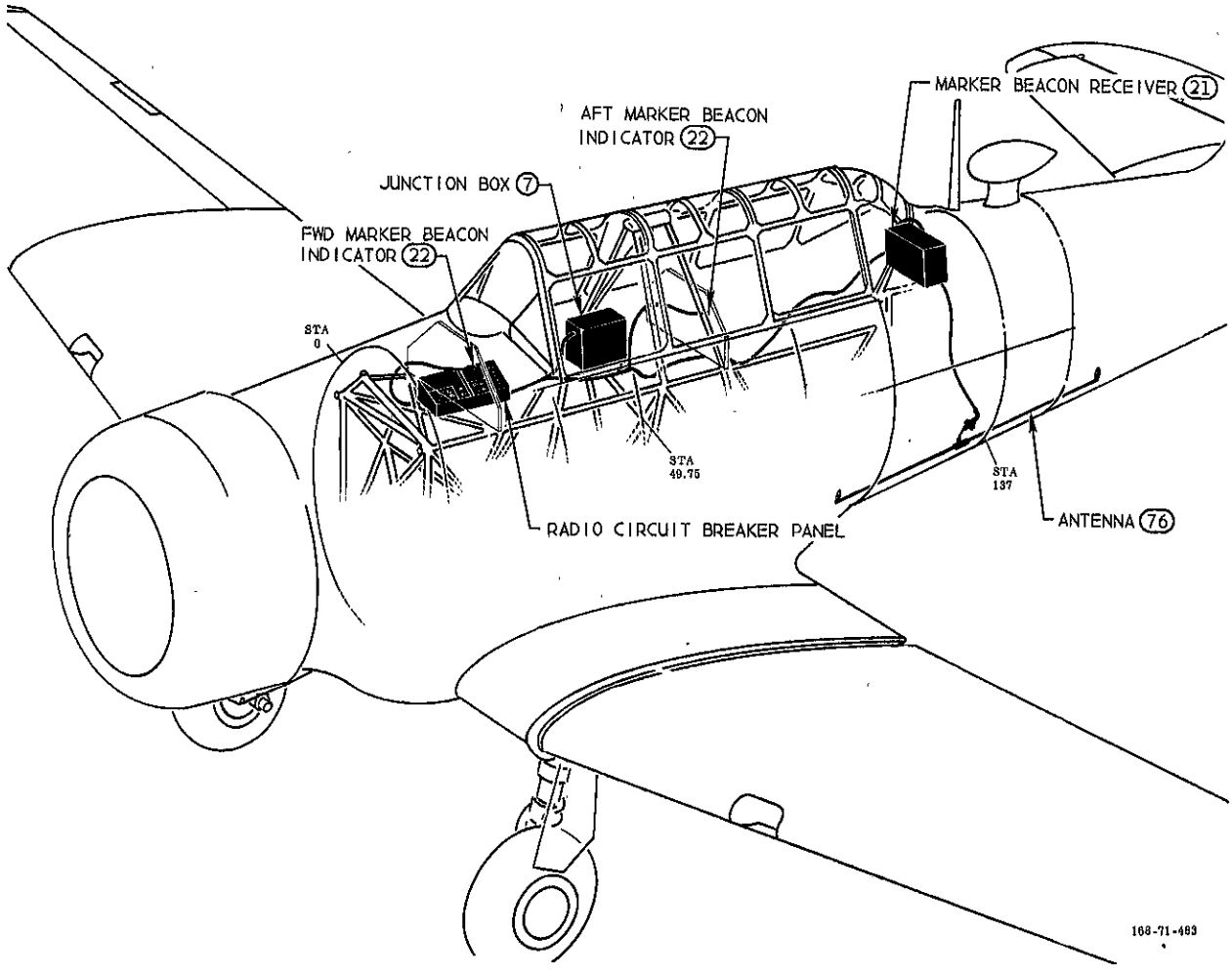


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
4	Bulb - Free Air Temperature (Front Cockpit)	AN5525-1
5	Bulb - Free Air Temperature (Rear Cockpit)	AN5525-1
6	Bulb - Carburetor Mixture Dual Element	174ND90 (Edison)
7	Bulb - Oil Temperature (Front Cockpit)	AN5525-1
8	Bulb - Oil Temperature (Rear Cockpit)	AN5525-1
12	Circuit Breaker - Carburetor Mixture Indicator (Front Cockpit)	AN3161-P5
13	Circuit Breaker - Carburetor Mixture Indicator (Rear Cockpit)	AN3161-P5
42	Circuit Breaker - Engine Gage Unit (Front Cockpit)	AN3161-P5
43	Circuit Breaker - Engine Gage Unit (Rear Cockpit)	AN3161-P5
45	Circuit Breaker - Free Air Temperature (Front and Rear Cockpits)	AN3161-P5
70	Indicator - Carburetor Mixture (Front Cockpit)	AN5790-6 (GFP)
71	Indicator - Carburetor Mixture (Rear Cockpit)	AN5790-6 (GFP)
72	Indicator - Free Air Temperature (Front Cockpit)	AN5790-6 (GFP)
73	Indicator - Engine Gage Unit (Front Cockpit)	AN5773-1 (GFP)
74	Indicator - Engine Gage Unit (Rear Cockpit)	AN5773-1 (GFP)
75	Indicator - Free Air Temperature (Rear Cockpit)	AN5790-6 (GFP)
120	Plug - Carburetor Mixture Bulb	AN3106-14S-7S
121	Plug - Carburetor Mixture Indicator (Front Cockpit)	AN3106-14S-2S
122	Plug - Carburetor Mixture Indicator (Rear Cockpit)	AN3106-14S-2S
124	Plug - Free Air Temperature Bulb (Front Cockpit)	AN3106-12S-3S
125	Plug - Free Air Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
128	Plug - Free Air Temperature Indicator (Rear Cockpit)	AN3106-14S-2S
130	Plug - Free Air Temperature Indicator (Front Cockpit)	AN3106-14S-2S
136	Plug - Oil Temperature Bulb (Front Cockpit)	AN3106-12S-3S
137	Plug - Oil Temperature Bulb (Rear Cockpit)	AN3106-12S-3S
138	Plug - Engine Gage Unit (Front Cockpit)	AN3106-14S-2S
139	Plug - Engine Gage Unit (Rear Cockpit)	AN3106-14S-2S
226	Panel - Circuit Breaker	182-54027 (NAA)
228	Console Assembly - Electric and Radio (Front Cockpit)	168-54005-20 (NAA)
231	Box Assembly - Main Power Panel	168-54072 (NAA)

Figure 8-11C. Carburetor Mixture, Oil, and Free Air Temperature

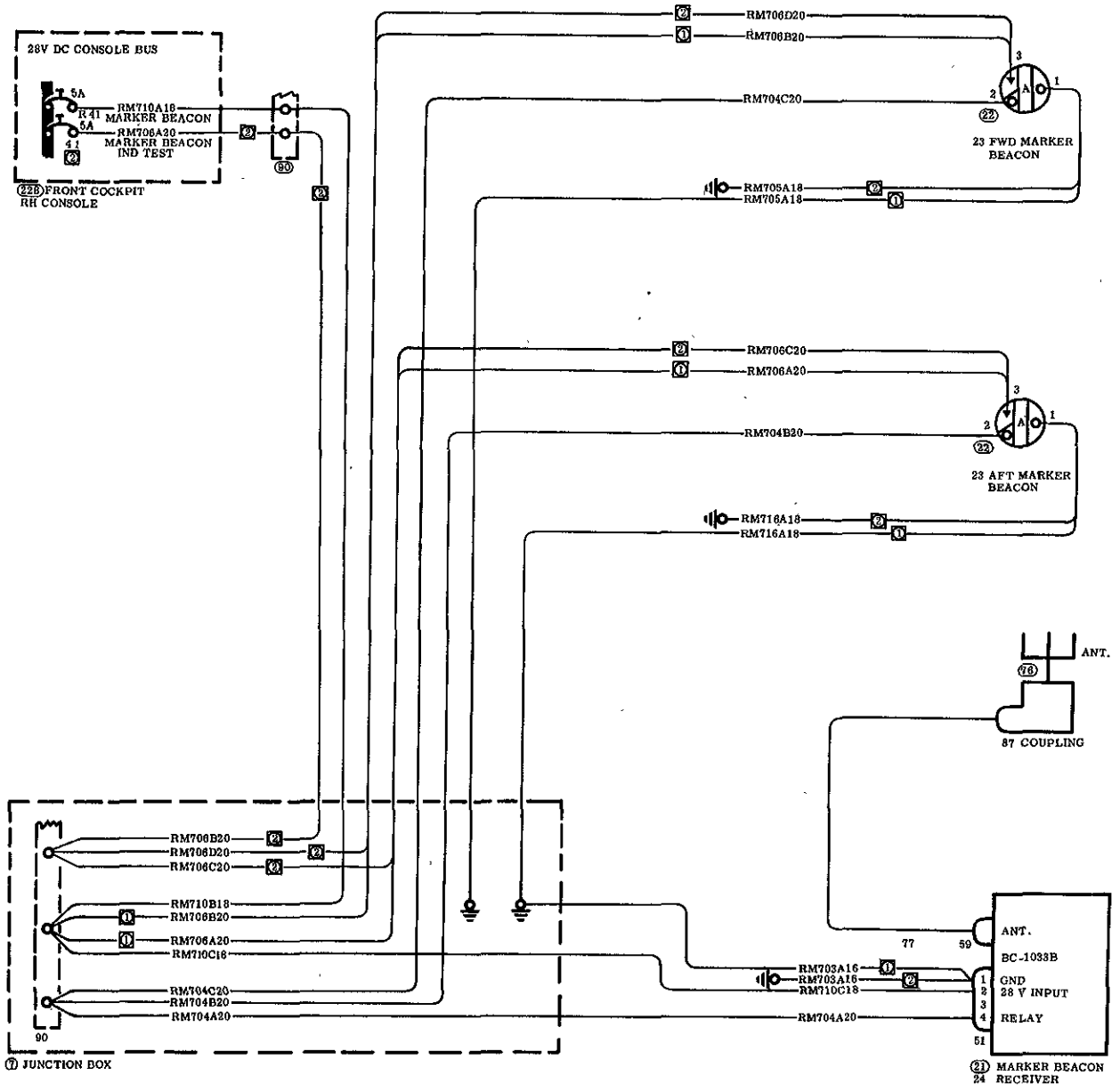


Indicators - Airplanes AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
7	Junction Box	168-71021 (NAA)
21	Receiver - Marker Beacon	BC-1033-B
22	Lamp Assembly	AN3157-4
23	Lamp	AN3121-313
24	Mounting - Marker Beacon Receiver	FT-161
41	Circuit Breaker - 5-amp	AN3161-P5
51	Plug	PL-108
59	Plug	PL-219
76	Antenna - Marker Beacon	88-71719 (NAA) 88-71719-5 (NAA)
77	Cable Assembly - Antenna	88-71271 (NAA) 88-71271-7 (NAA)
87	Coupling - Marker Beacon Antenna	MC-277
90	Terminal Strip	NAS 45-6-( )
*228	Console - Forward Right-hand	168-54005 (NAA) 168-54005-20 (NAA)
	*Electrical Item Numbers	

Figure 8-12. Marker Beacon - Airplanes AF49-2897 Through AF49-3537,

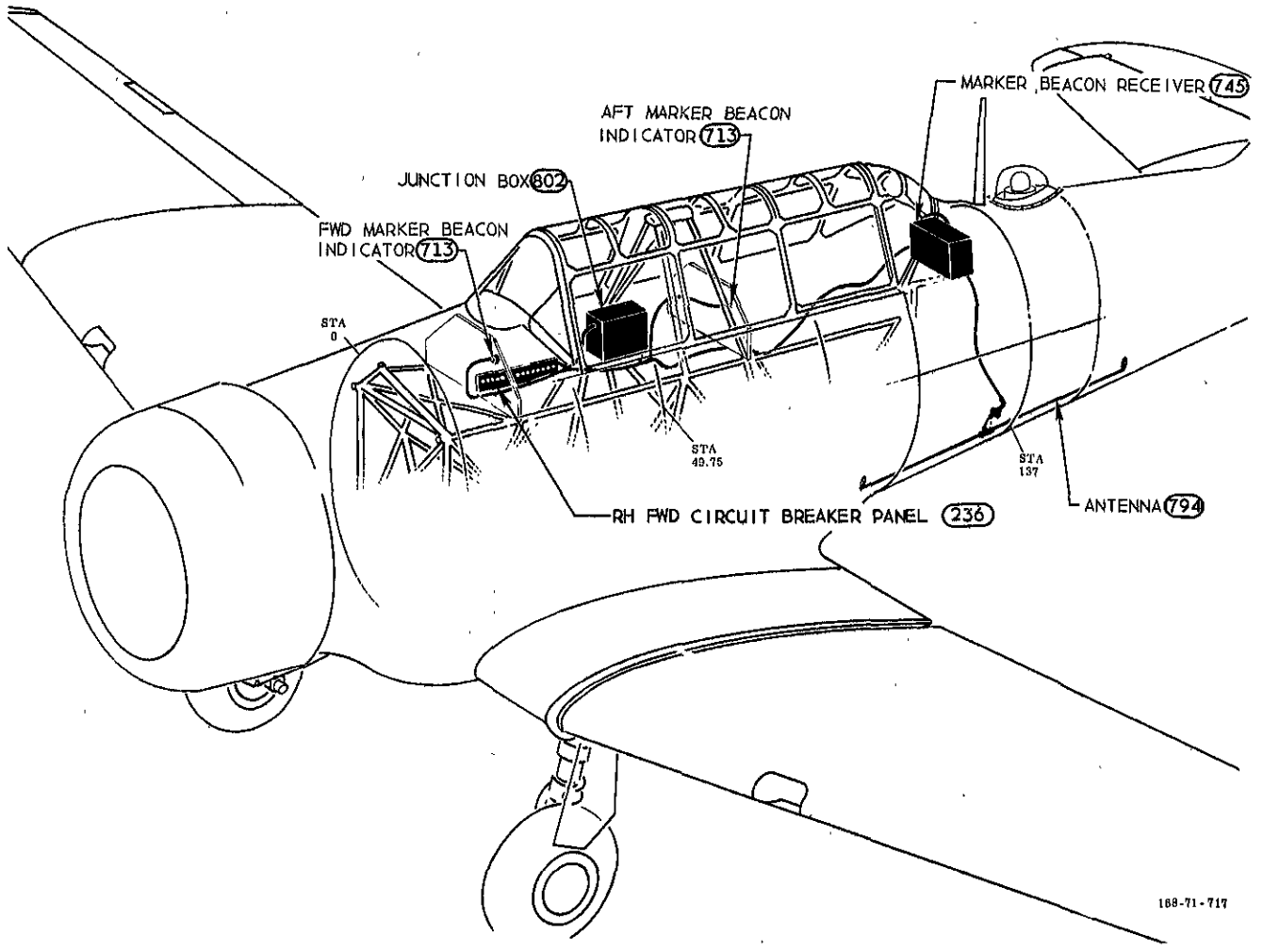


R DENOTES RADIO ITEM NO.

1 AIRPLANES AF49-2697 THRU AF49-2981

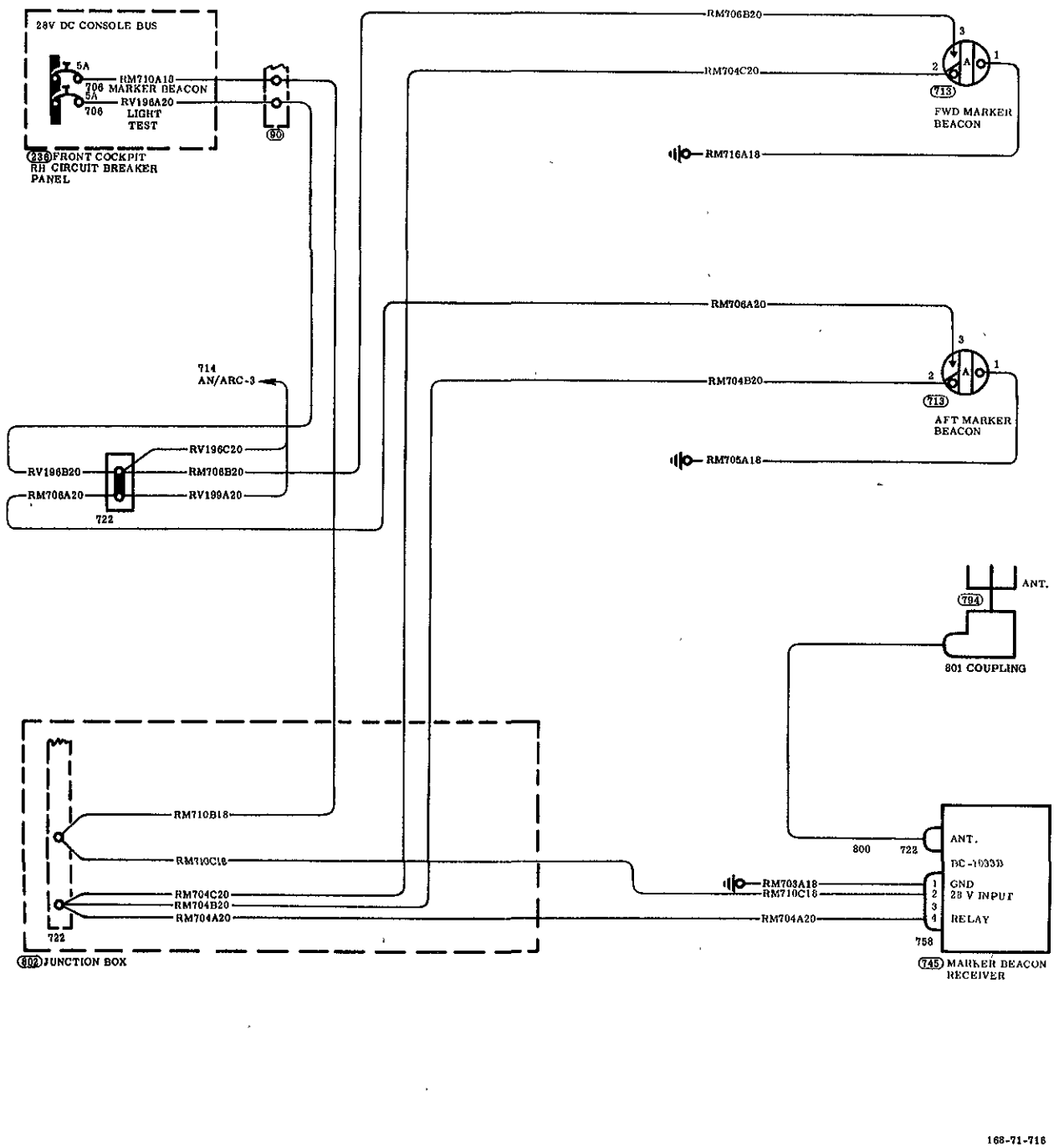
2 AIRPLANES AF49-2982 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16083

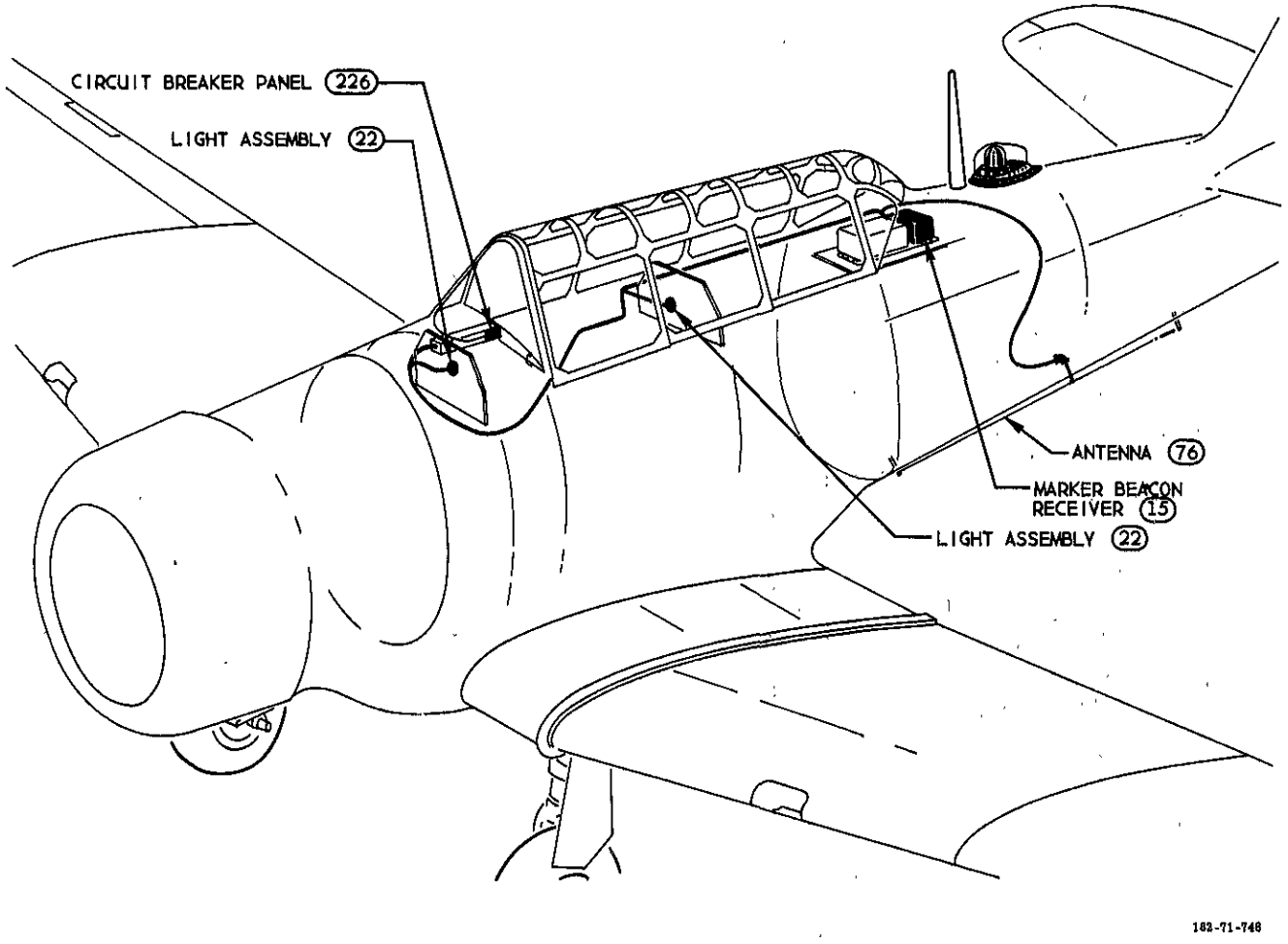
168-71-474E
19



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
90	Terminal Strip	NAS45-6
236	Panel - Forward Right-hand Circuit Breaker	168-54082 (NAA)
706	Circuit Breaker	AN3161-P5
713	Light Assembly	AN3157-4
722	Terminal Strip	NAS45-6
745	Receiver - Marker Beacon	BC-1033-B
758	Plug	PL-108
794	Antenna - Marker Beacon	88-71719-5
801	Coupling - Marker Beacon Antenna	MC-277
802	Junction Box	168-71056

Figure 8-12A. Marker Beacon -

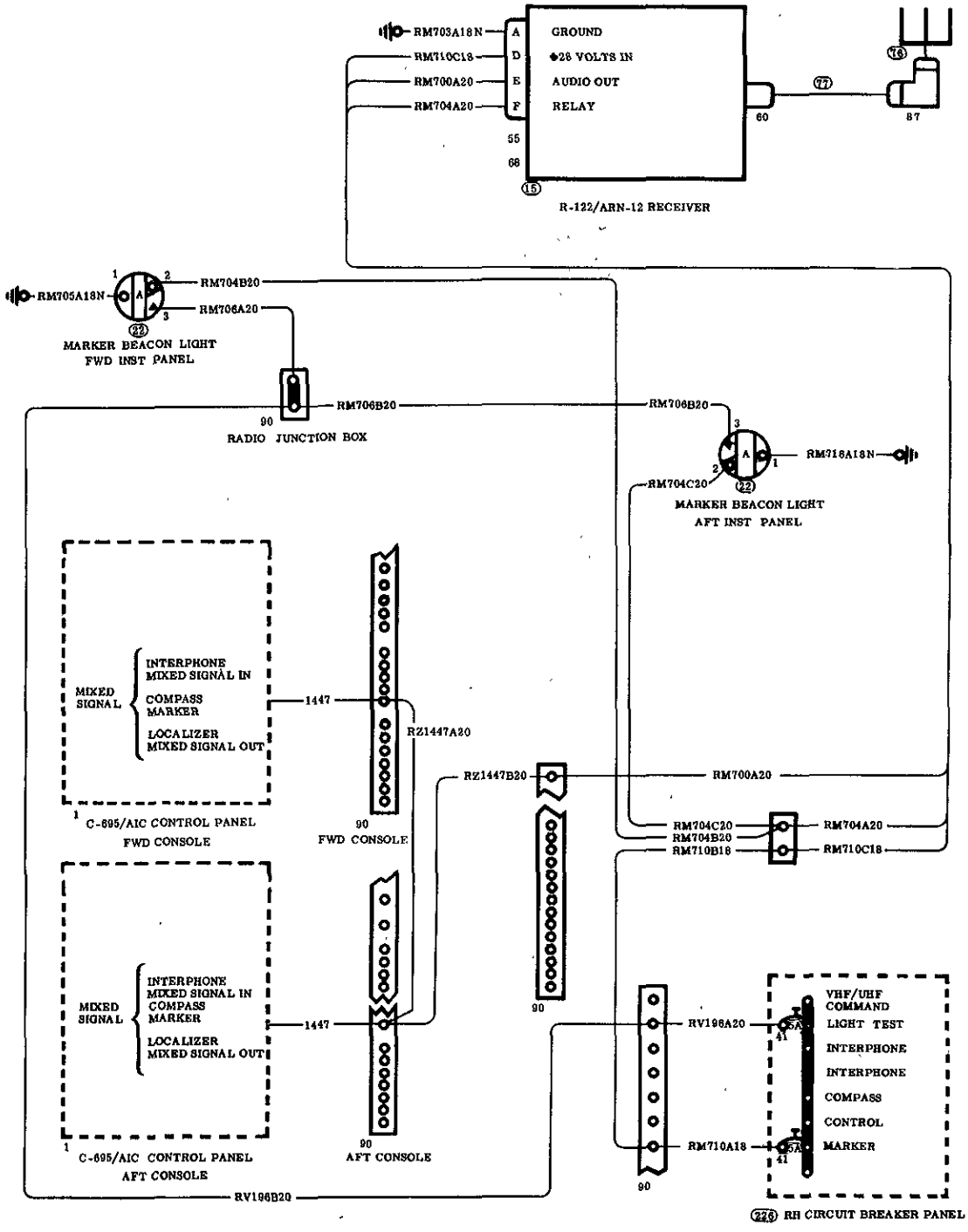

28V DC CONSOLE BUS
5A
706
RM710A18
MARKER BEACON
5A
706
RV196A20
LIGHT TEST
90
238 FRONT COCKPIT RH CIRCUIT BREAKER PANEL
RM706B20
RM704C20
3
2
A
1
713
FWD MARKER BEACON
RM716A18
RM706A20
714
AN/ARC-3
RM704B20
713
AFT MARKER BEACON
RM705A18
RV196C20
RV196B20
RM706B20
RM706A20
RV199A20
722
ANT.
794
801 COUPLING
RM710B18
RM710C18
RM704C20
RM704B20
RM704A20
722
800
722
ANT.
BC-1033D
RM703A18
RM710C18
RM704A20
1 GND
2 28 V INPUT
3
4 RELAY
758
802 JUNCTION BOX
745 MARKER BEACON RECEIVER
168-71-716
192

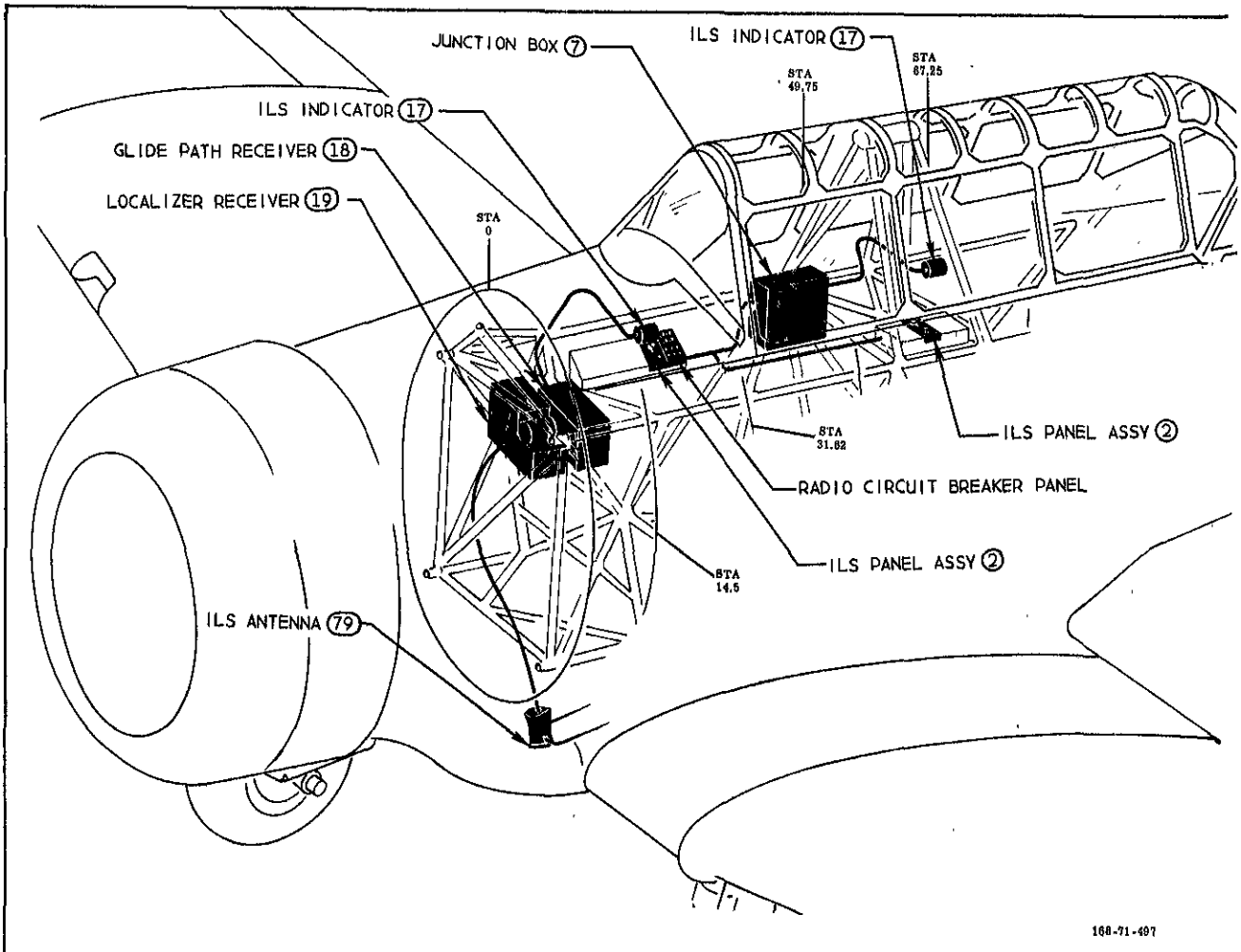


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Interphone Control	C-695/AIC
15	Receiver - Marker Beacon	R-122/ARN-12
22	Light Assembly	AN3157-4
41	Circuit Breaker	AN3161-P5
55	Plug	AN3106B-18-9S
60	Plug	PL-259-A
68	Adapter	AN3057-10
76	Antenna	82-71719-5
77	Antenna Cable	88-71271-10
87	Coupling	MC-277
90	Terminal Strip	NAS45-6-( )
*226	Panel - Circuit Breaker	182-54027 (NAA)

*Electrical Item Number

Figure 8-12B. Marker Beacon - Airplanes AF51-14314

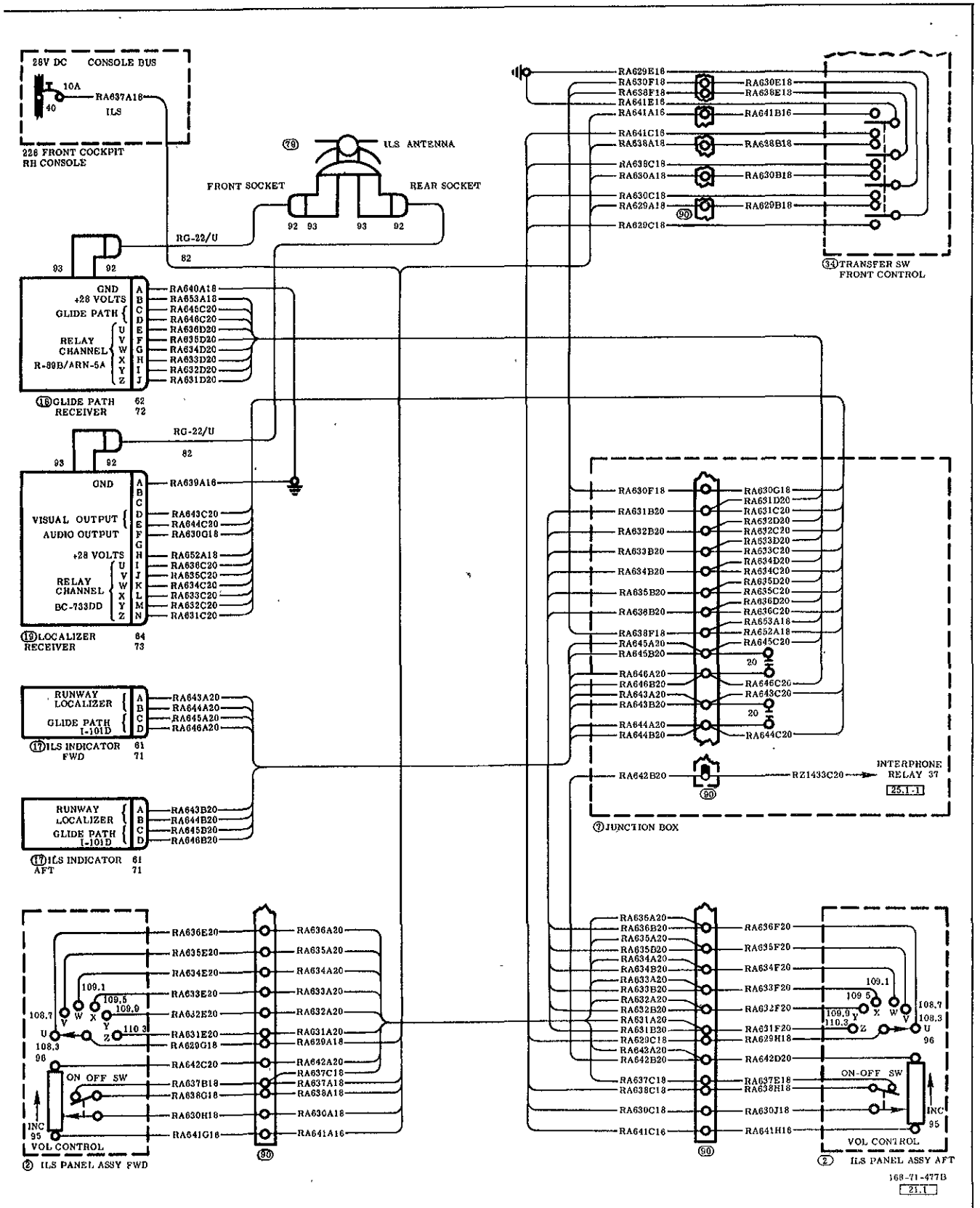

RM703A18N
RM710C18
RM700A20
RM704A20
A
D
E
F
GROUND
+28 VOLTS IN
AUDIO OUT
RELAY
55
66
15
R-122/ARN-12 RECEIVER
60
77
87
76
RM705A18N
RM704B20
RM706A20
22
MARKER BEACON LIGHT
FWD INST PANEL
90
RADIO JUNCTION BOX
RM706B20
RM706B20
RM716A18N
RM704C20
MARKER BEACON LIGHT
AFT INST PANEL
MIXED SIGNAL
INTERPHONE MIXED SIGNAL IN
COMPASS MARKER
LOCALIZER MIXED SIGNAL OUT
1447
RZ1447A20
C-695/AIC CONTROL PANEL
FWD CONSOLE
FWD CONSOLE
RZ1447B20
RM700A20
RM704C20
RM704B20
RM710B18
RM704A20
RM710C18
MIXED SIGNAL
INTERPHONE MIXED SIGNAL IN
COMPASS MARKER
LOCALIZER MIXED SIGNAL OUT
1447
C-695/AIC CONTROL PANEL
AFT CONSOLE
AFT CONSOLE
RV196A20
RM710A18
VHF/UHF COMMAND
LIGHT TEST
INTERPHONE
INTERPHONE
COMPASS
CONTROL
MARKER
6A
41
RV196B20
276
RH CIRCUIT BREAKER PANEL
C19.1
182-71-738

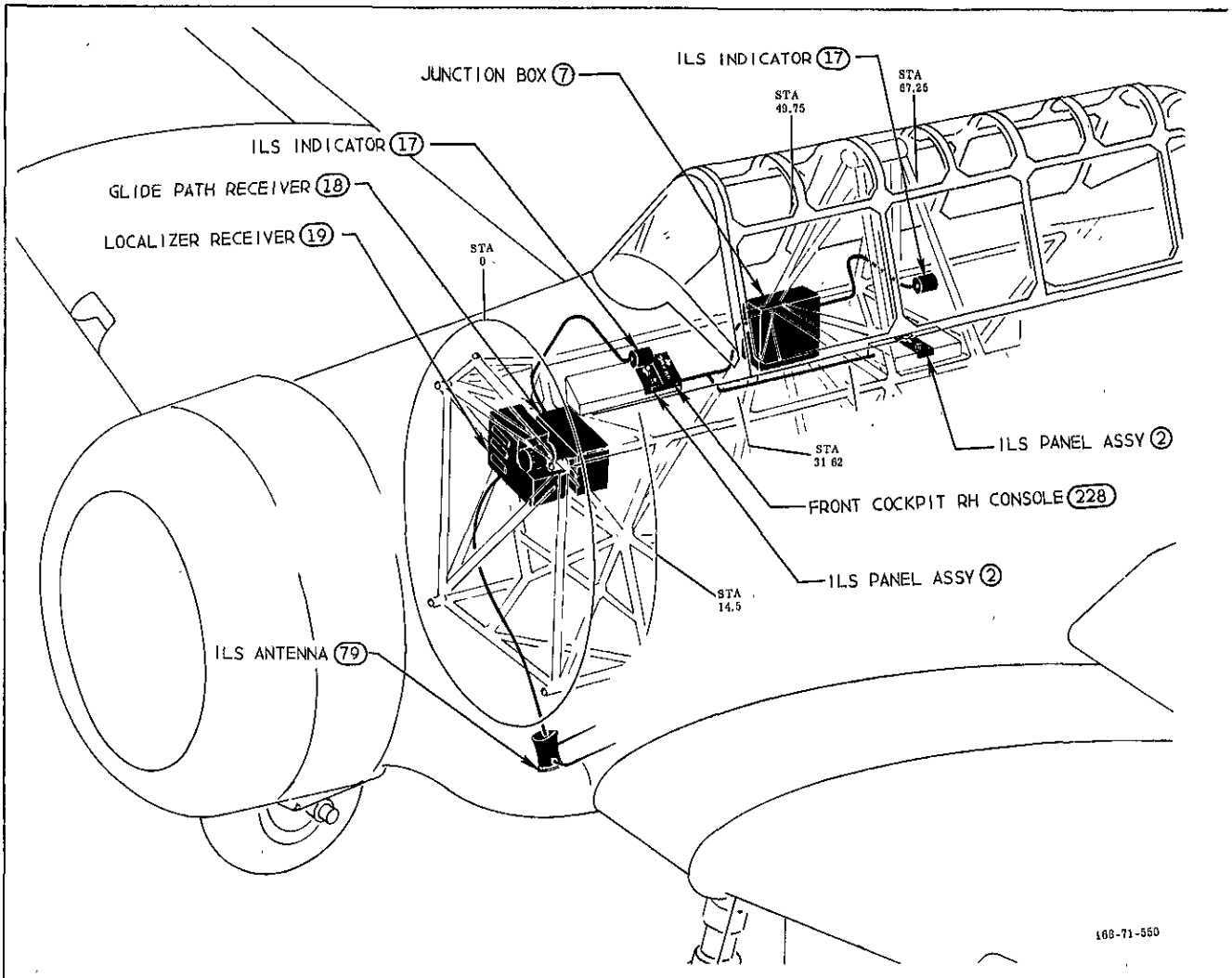


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
2	Panel Assembly - ILS	168-71016 (NAA)
7	Junction Box	168-71021 (NAA)
17	Indicator - ILS	I-101-D
18	Receiver - Glide Path	R-89B/ARN-5A
19	Receiver - Localizer	BC-733-D
20	Capacitor	3DKB1250
34	Switch - Transfer 4PDT	AN3227-3
37	Relay - Interphone 4PDT	6213A (Advance)
40	Circuit Breaker - 10-amp	AN3161-P10
61	Plug	AN3106-14S-2S
62	Plug	AN3106-18-1S
64	Plug	AN3106-20-27S
	*Electrical Item Number	

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
71	Cable Clamp	AN3057-6
72	Cable Clamp	AN3057-10
73	Cable Clamp	AN3057-12
79	Antenna - ILS	168-71068
82	Cable - Coaxial ILS	RG-22/U
90	Terminal Strip	NAS 45-6-( )
92	Plug	UG-102/U
93	Adapter - Right-angle	UG-104/U
95	Control	V137
96	Switch - Selector	1401
*228	Console - Forward Right-hand	168-54005 (NAA)

Figure 8-13. Instrument Landing System -

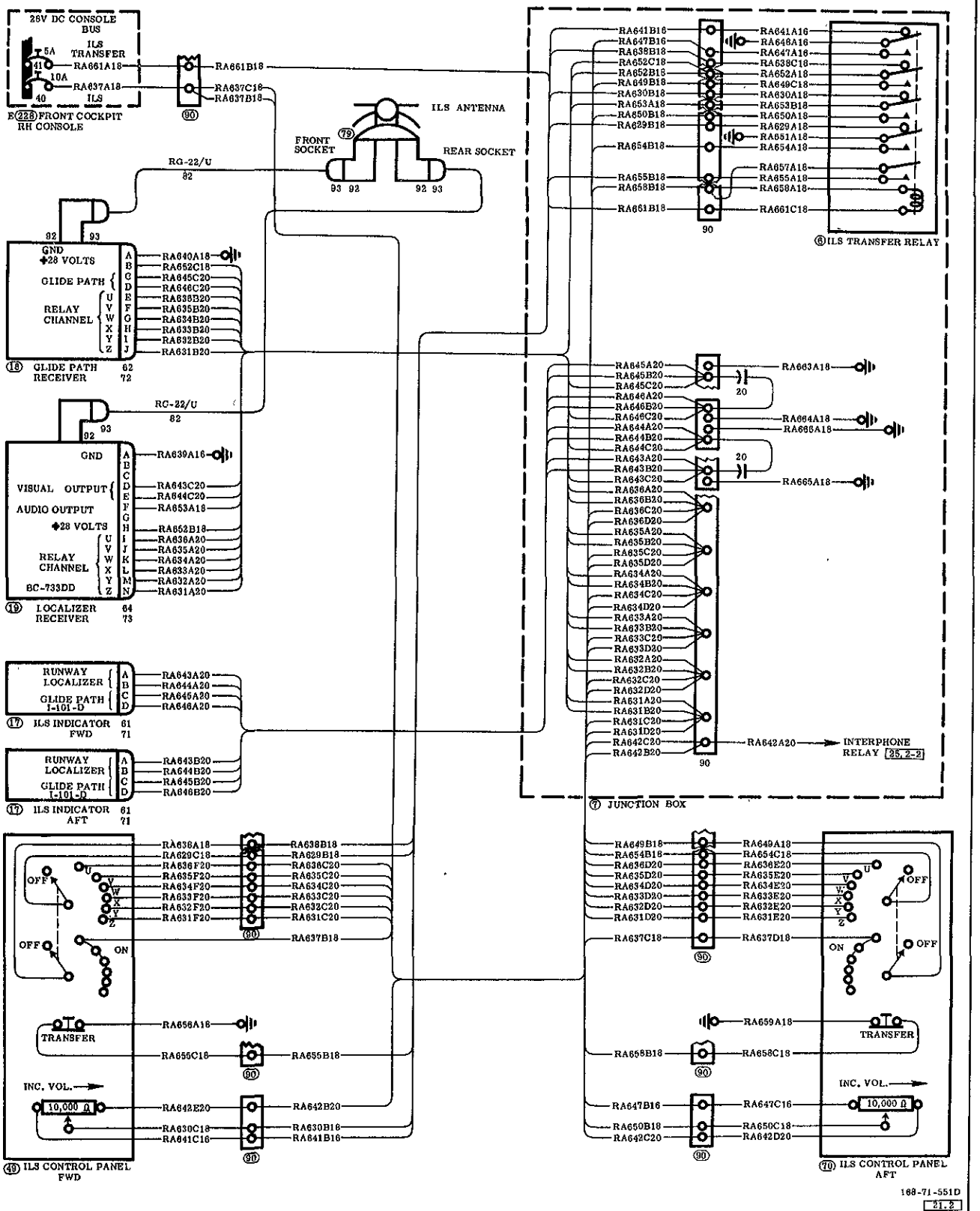

28V DC CONSOLE BUS
10A
RA637A18
ILS
226 FRONT COCKPIT RH CONSOLE
79 ILS ANTENNA
FRONT SOCKET
REAR SOCKET
92 93 93 92
RG-22/U
82
93 92
GND
+28 VOLTS
GLIDE PATH
RELAY CHANNEL
R-89B/ARN-5A
RA640A18
RA653A18
RA645C20
RA646C20
RA636D20
RA635D20
RA634D20
RA633D20
RA632D20
RA631D20
18 GLIDE PATH RECEIVER 62 72
RG-22/U
82
93 92
GND
RA639A16
VISUAL OUTPUT
AUDIO OUTPUT
+28 VOLTS
RELAY CHANNEL
BC-733DD
RA643C20
RA644C20
RA630G18
RA652A18
RA636C20
RA635C20
RA634C20
RA633C20
RA632C20
RA631C20
19 LOCALIZER RECEIVER 64 73
RUNWAY LOCALIZER
GLIDE PATH I-101D
RA643A20
RA644A20
RA645A20
RA646A20
17 ILS INDICATOR FWD 61 71
RUNWAY LOCALIZER
GLIDE PATH I-101D
RA643B20
RA644B20
RA645B20
RA646B20
17 ILS INDICATOR AFT 61 71
RA629E18
RA630F18
RA638F18
RA641E18
RA641A16
RA641C18
RA638A18
RA638C18
RA630A18
RA630C18
RA629A18
RA629C18
90
RA630E18
RA638E18
RA641B16
RA638B18
RA630B18
RA629B18
34 TRANSFER SW FRONT CONTROL
RA630F18
RA631B20
RA632B20
RA633B20
RA634B20
RA635B20
RA636B20
RA638B20
RA638F18
RA645A20
RA645B20
RA646A20
RA646B20
RA643A20
RA643B20
RA644A20
RA644B20
RA630G18
RA631D20
RA631C20
RA632D20
RA632C20
RA633D20
RA633C20
RA634D20
RA634C20
RA635D20
RA635C20
RA636D20
RA636C20
RA653A18
RA652A18
RA645C20
20
RA646C20
RA643C20
20
RA644C20
RA642B20
90
RZ1433C20
INTERPHONE RELAY 37
25.1-1
7 JUNCTION BOX
RA636E20
RA635E20
RA634E20
RA633E20
RA632E20
RA631E20
RA629G18
RA642C20
RA637B18
RA638G18
RA630H18
RA641G18
108.7
108.3
109.1
109.5
109.9
110.3
ON OFF SW
INC
95
VOL CONTROL
2 ILS PANEL ASSY FWD
90
RA636A20
RA635A20
RA634A20
RA633A20
RA632A20
RA631A20
RA629A18
RA642A20
RA637C18
RA637A18
RA638A18
RA630A18
RA641A16
RA636F20
RA635F20
RA634F20
RA633F20
RA632F20
RA631F20
RA629H18
RA642D20
RA637E18
RA638H18
RA630J18
RA641H16
ON-OFF SW
VOL CONTROL
2 ILS PANEL ASSY AFT
168-71-477B
21.1

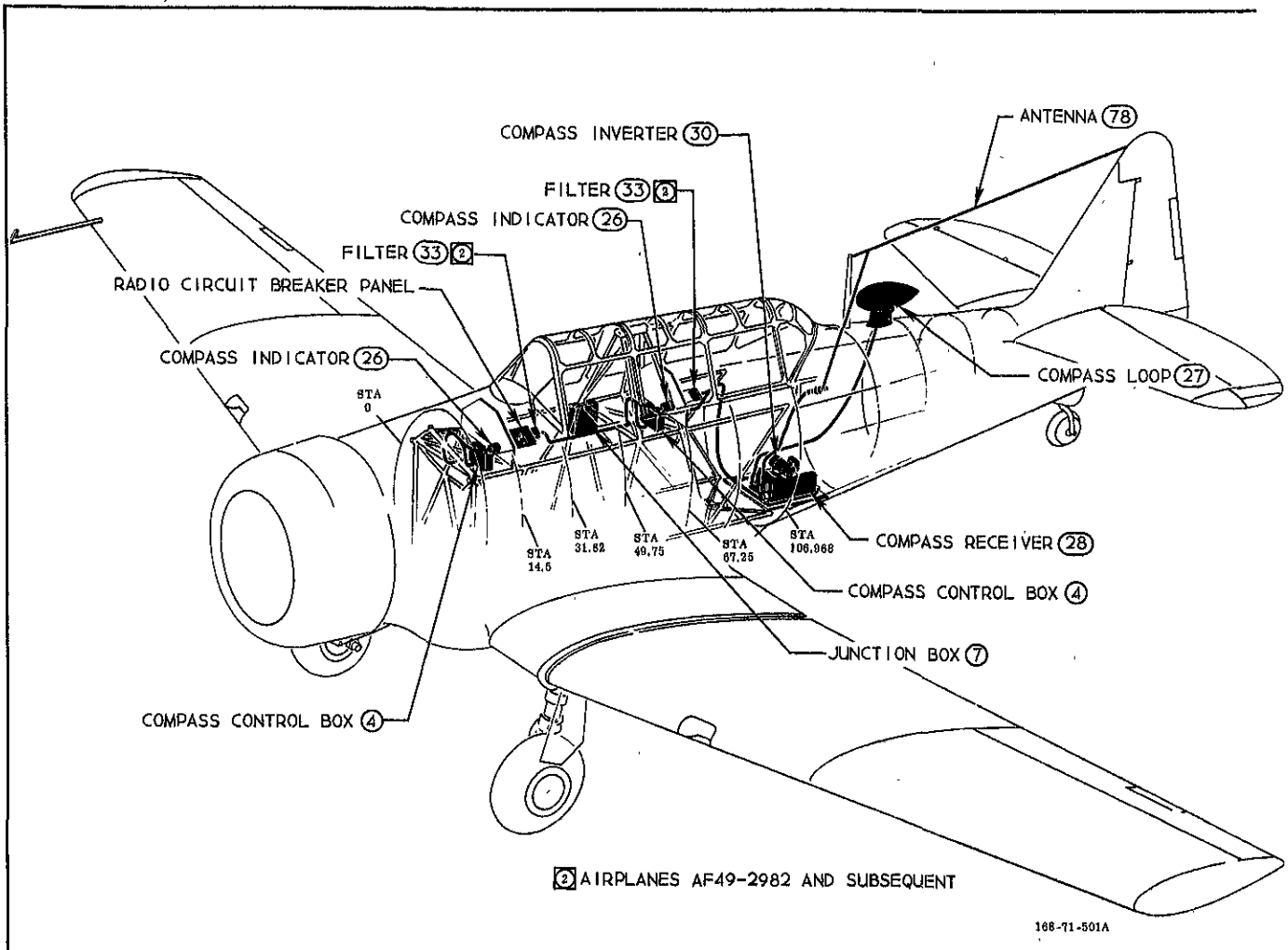


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
6	Relay - ILS Transfer	182ADX57 (Struthers Dunn)
7	Junction Box	168-71021 (NAA)
17	Indicator - ILS	I-101-D
18	Receiver - Glide Path	R-89B/ARN-5B
19	Receiver - Localizer	BC-733-DD
20	Capacitor	3DKB1250
40	Circuit Breaker - 10-amp	AN3161-P10
41	Circuit Breaker - 5-amp	AN3161-P5
49	Panel Assembly - ILS Forward	168-71063-10 (NAA)
61	Plug	AN3106-14S-2S
62	Plug	AN3108-18-1S
	*Electrical Item Number	

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
64	Plug	AN3108-20-27S
70	Panel Assembly - ILS Aft	168-71063 (NAA)
71	Cable Clamp	AN3057-6
72	Cable Clamp	AN3057-10
73	Cable Clamp	AN3057-12
79	Antenna - ILS	AS-27A/ARN-5
82	Cable - Coaxial ILS	RG-22/U
90	Terminal Strip	NAS 45-6-( )
92	Plug	UG-102/U
93	Adapter - Right-angle	UG-104/U
*228	Console - Forward Right-hand	168-54005 (NAA)

Figure 8-13A. Instrument Landing System - Airplanes AF49-2982 Through AF49-3537, AF50-1277

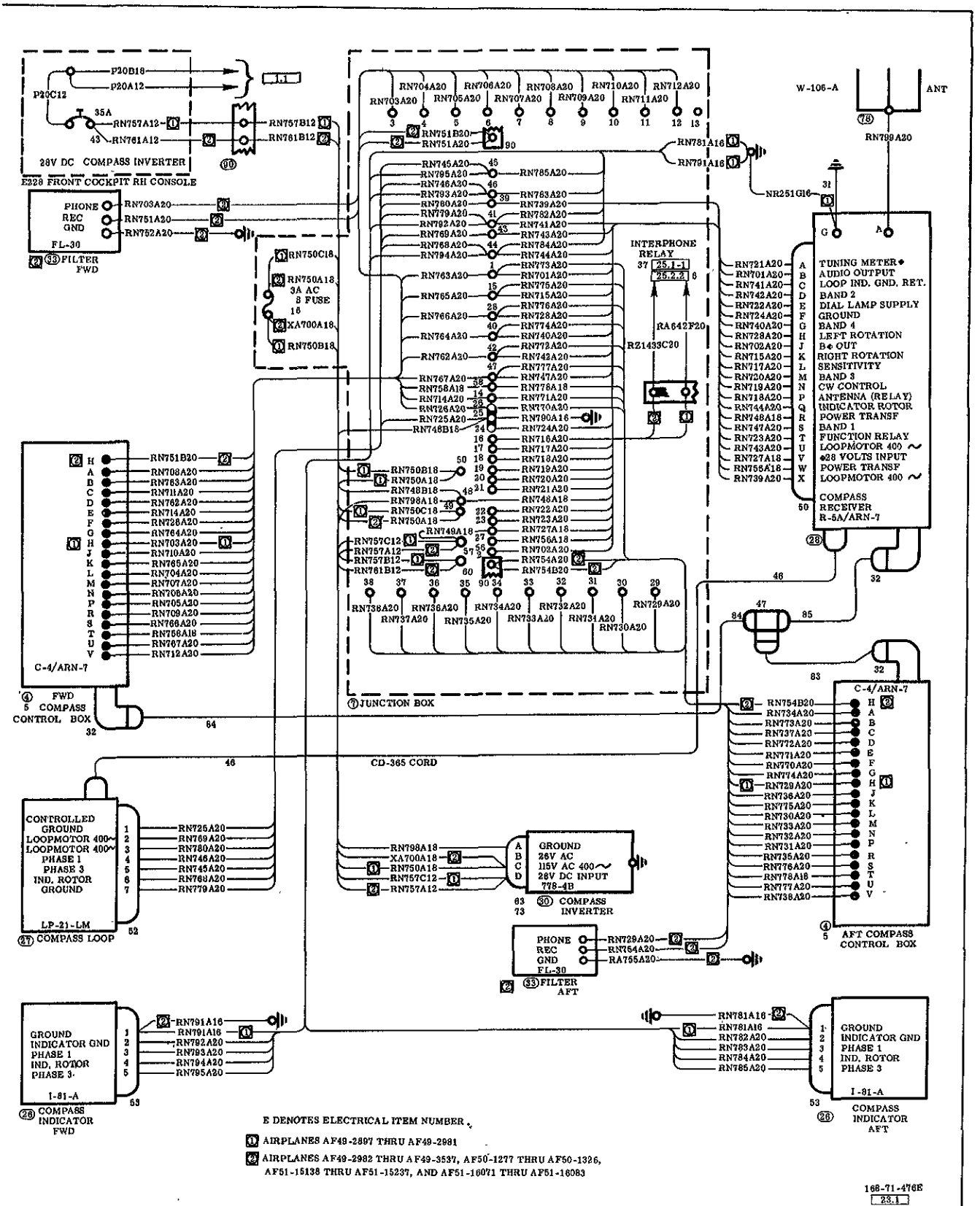

26V DC CONSOLE BUS
ILS TRANSFER
5A
10A
RA661A18
RA637A18
ILS
E(228) FRONT COCKPIT RH CONSOLE
RA661B18
RA637C18
RA637B18
(90)
ILS ANTENNA
FRONT SOCKET (79)
REAR SOCKET
93 92
92 93
RG-22/U
82
92
93
GND
+28 VOLTS
GLIDE PATH
RELAY CHANNEL
RA640A18
RA652C18
RA645C20
RA646C20
RA638B20
RA635B20
RA634B20
RA633B20
RA632B20
RA631B20
(18) GLIDE PATH RECEIVER 62 72
RG-22/U
82
92
93
GND
VISUAL OUTPUT
AUDIO OUTPUT
+28 VOLTS
RELAY CHANNEL
BC-733DD
RA639A16
RA643C20
RA644C20
RA653A18
RA653B18
RA636A20
RA635A20
RA634A20
RA633A20
RA632A20
RA631A20
(19) LOCALIZER RECEIVER 64 73
RUNWAY LOCALIZER
GLIDE PATH I-101-D
RA643A20
RA644A20
RA645A20
RA646A20
(17) ILS INDICATOR FWD 61 71
RUNWAY LOCALIZER
GLIDE PATH I-101-D
RA643B20
RA644B20
RA645B20
RA646B20
(17) ILS INDICATOR AFT 61 71
RA641B16
RA647B16
RA638B18
RA652C18
RA652B18
RA649B18
RA630B18
RA653A18
RA650B18
RA629B18
RA654B18
RA655B18
RA658B18
RA661B18
90
RA641A16
RA648A16
RA647A16
RA638C18
RA652A18
RA649C18
RA630A18
RA653B18
RA650A18
RA629A18
RA651A18
RA654A18
RA657A16
RA655A18
RA658A18
RA661C18
(8) ILS TRANSFER RELAY
RA645A20
RA645B20
RA645C20
RA646A20
RA646B20
RA646C20
RA644A20
RA644B20
RA644C20
RA643A20
RA643B20
RA643C20
RA636A20
RA636B20
RA636C20
RA636D20
RA635A20
RA635B20
RA635C20
RA635D20
RA634A20
RA634B20
RA634C20
RA634D20
RA633A20
RA633B20
RA633C20
RA633D20
RA632A20
RA632B20
RA632C20
RA632D20
RA631A20
RA631B20
RA631C20
RA631D20
RA642C20
RA642B20
20
20
RA663A18
RA664A18
RA665A18
RA666A18
RA665A18
90
RA642A20
INTERPHONE RELAY 25, 2-2
(7) JUNCTION BOX
RA636A18
RA629C18
RA636F20
RA635F20
RA634F20
RA633F20
RA632F20
RA631F20
RA638B18
RA629B18
RA636C20
RA635C20
RA634C20
RA633C20
RA632C20
RA631C20
RA637B18
(90)
OFF
U
V
W
X
Y
Z
OFF
ON
RA656A18
TRANSFER
RA655C18
RA655B18
(90)
INC. VOL.
10,000 Ω
RA642E20
RA642B20
RA630C18
RA641C16
RA630B18
RA641B16
(90)
(40) ILS CONTROL PANEL FWD
RA649B18
RA654B18
RA636D20
RA635D20
RA634D20
RA633D20
RA632D20
RA631D20
RA637C18
RA649A18
RA654C18
RA636E20
RA635E20
RA634E20
RA633E20
RA632E20
RA631E20
RA637D18
(90)
OFF
U
V
W
X
Y
Z
ON
OFF
RA659A18
TRANSFER
RA658B18
RA658C18
(90)
INC. VOL.
10,000 Ω
RA647B16
RA650B18
RA642C20
RA647C16
RA650C18
RA642D20
(90)
(70) ILS CONTROL PANEL AFT
168-71-551D
21.2

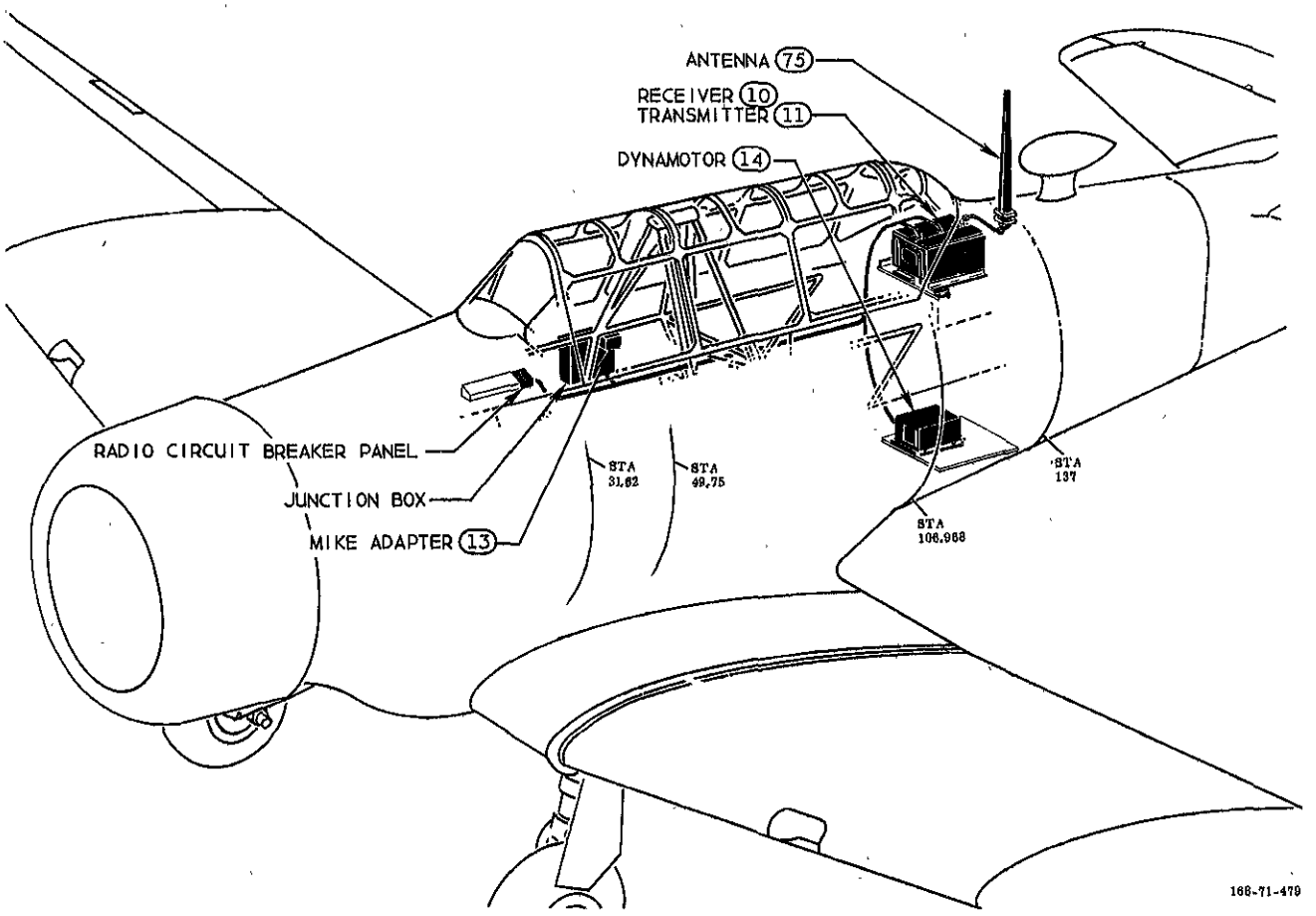


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
4	Control Box - Compass	C-4/ARN-7
5	Mounting - Compass Control Box	FT-224-A
7	Junction Box	168-71021 (NAA)
8	Fuse - Spare	3AG
16	Holder - Spare Fuse	342001 (Littelfuse)
26	Indicator - Compass	I-81-A
27	Compass Loop	LP-21-M
28	Receiver - Compass	R-5A/ARN-7
30	Inverter - Compass	778-4B
31	Jumper - Ground	1J1-2-2-8
32	Adapter - Right-angle Compass Tuning	MC-136
33	Filter	FL-30
43	Circuit Breaker - 35-amp	AN3161-P35
46	Cord - Compass Loop	CD-365
47	Coupling "T" - Compass Tuning	MC-203-A
50	Plug	PL-122
	*Electrical Item Number	

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
*51	Circuit Breaker - Starter	AN3161-P15
52	Plug	PL-112
53	Plug	PL-118
63	Plug	AN3106-20-4S
73	Cable Clamp	AN3057-12
78	Antenna - Compass Sense	W-106-A
83	Tuning Shaft - Compass	LA-1564 (F.W. Stewart) LA-1564-39 (F.W. Stewart)
84	Tuning Shaft - Compass	LA-1564 (F.W. Stewart) LA-1564-76 (F.W. Stewart)
85	Tuning Shaft - Compass	LA-1564 (F.W. Stewart) LA-1564-93 (F.W. Stewart)
90	Terminal Strip	NAS 45-6-( )
*228	Console - Forward Right-hand	168-54005 (NAA), 168-54005-20 (NAA)

Figure 8-14. AN/ARN-7 Radio Compass Control - Airplanes AF49-2897 Through AF49-3537, AF50-1277

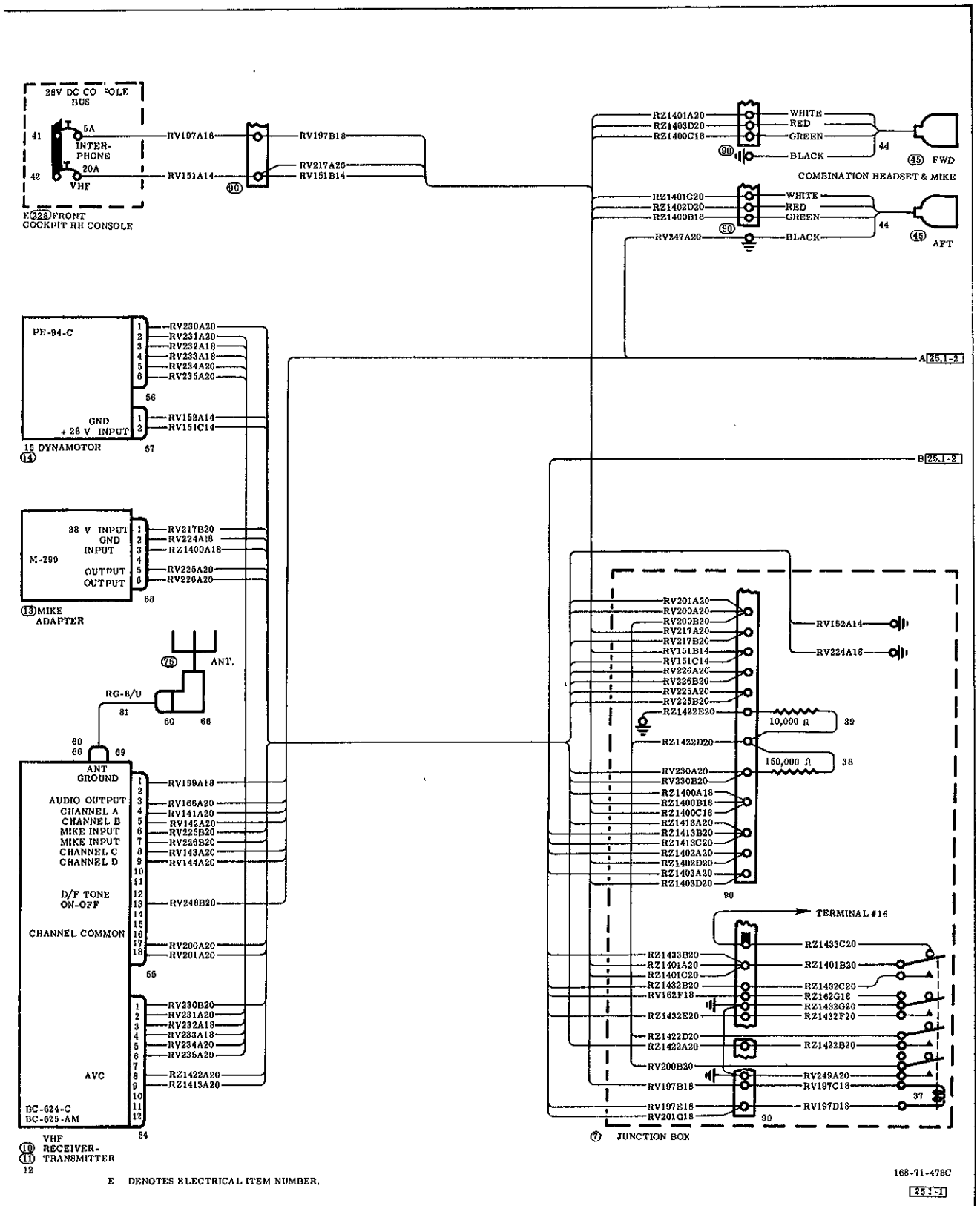

28V DC COMPASS INVERTER
E228 FRONT COCKPIT RH CONSOLE
P20B16
P20A12
P20C12
35A
RN757A12
RN761A12
RN757B12
RN761B12
PHONE REC GND
FL-30
FILTER FWD
RN703A20
RN751A20
RN752A20
RN750C18
RN750A18
3A AC 8 FUSE
XA700A16
RN750B18
RN704A20 RN706A20 RN708A20 RN710A20 RN712A20
RN703A20 RN705A20 RN707A20 RN709A20 RN711A20
RN751B20
RN751A20
RN745A20 RN746A30 RN793A20 RN780A20 RN779A20 RN792A20 RN769A20 RN768A20 RN794A20
RN763A20 RN765A20 RN766A20 RN764A20 RN762A20
RN767A20 RN758A18 RN714A20 RN726A20 RN725A20 RN746B18
RN785A20 RN783A20 RN739A20 RN732A20 RN741A20 RN743A20 RN734A20 RN744A20 RN773A20 RN701A20 RN775A20 RN715A20 RN776A20 RN728A20 RN774A20 RN740A20 RN772A20 RN742A20 RN777A20 RN747A20 RN778A18 RN771A20 RN770A20 RN790A16 RN724A20 RN716A20 RN717A20 RN718A20 RN719A20 RN720A20 RN721A20 RN748A18 RN722A20 RN723A20 RN727A18 RN756A18 RN702A20 RN754A20 RN754B20
RN781A16
RN791A16
NR251G16
W-106-A
ANT
RN799A20
INTERPHONE RELAY
25.1-1
25.2.2
RA642F20
RZ1433C20
RN721A20 RN701A20 RN741A20 RN742A20 RN722A20 RN724A20 RN740A20 RN728A20 RN702A20 RN715A20 RN717A20 RN720A20 RN719A20 RN718A20 RN744A20 RN748A18 RN747A20 RN723A20 RN743A20 RN727A18 RN756A18 RN739A20
TUNING METER
AUDIO OUTPUT
LOOP IND. GND. RET.
BAND 2
DIAL LAMP SUPPLY
GROUND
BAND 4
LEFT ROTATION
B+ OUT
RIGHT ROTATION
SENSITIVITY
BAND 3
CW CONTROL
ANTENNA (RELAY)
INDICATOR ROTOR
POWER TRANSF
BAND 1
FUNCTION RELAY
LOOPMOTOR 400
28 VOLTS INPUT
POWER TRANSF
LOOPMOTOR 400
COMPASS RECEIVER R-5A/ARN-7
C-4/ARN-7
FWD 5 COMPASS CONTROL BOX
JUNCTION BOX
RN738A20 RN737A20 RN736A20 RN735A20 RN734A20 RN733A20 RN732A20 RN731A20 RN730A20 RN729A20
CD-365 CORD
CONTROLLED GROUND
LOOPMOTOR 400
LOOPMOTOR 400
PHASE 1
PHASE 3
IND. ROTOR GROUND
LP-21-LM
COMPASS LOOP
RN725A20 RN769A20 RN780A20 RN746A20 RN745A20 RN768A20 RN779A20
RN798A18
XA700A18
RN750A18
RN757C12
RN757A12
GROUND 26V AC 115V AC 400 28V DC INPUT 778-4B
COMPASS INVERTER
PHONE REC GND
FL-30
FILTER AFT
RN729A20 RN764A20 RA755A20
AFT COMPASS CONTROL BOX
GROUND INDICATOR GND PHASE 1 IND. ROTOR PHASE 3
I-81-A
COMPASS INDICATOR FWD
RN791A16 RN781A16 RN782A20 RN783A20 RN784A20 RN785A20
COMPASS INDICATOR AFT
E DENOTES ELECTRICAL ITEM NUMBER.
AIRPLANES AF49-2897 THRU AF49-2981
AIRPLANES AF49-2982 THRU AF49-3537, AF50-1277 THRU AF50-1326, AF51-15138 THRU AF51-15237, AND AF51-16071 THRU AF51-16083
168-71-476E
23.1



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
7	Junction Box	168-71021 (NAA)
10	Receiver - VHF	BC-624-C
11	Transmitter - VHF	BC-625-AM
12	Mounting - Receiver-Transmitter	FT-224-A
13	Adapter - Microphone	M-299
14	Dynamotor	PE-94C
15	Mounting - Dynamotor	FT-498
37	Relay - Interphone 4PDT	6213A (Advance)
38	Resistor - 150,000-ohm 1/2-watt	168-71036-3 (NAA)
39	Resistor - 10,000-ohm 1/2-watt	168-71036 (NAA)
41	Circuit Breaker - 5-amp	AN3161-P5
42	Circuit Breaker - 20-amp	AN3161-P20
44	Cord - Headset and Microphone	WF-5/U
	* Electrical Item Number	

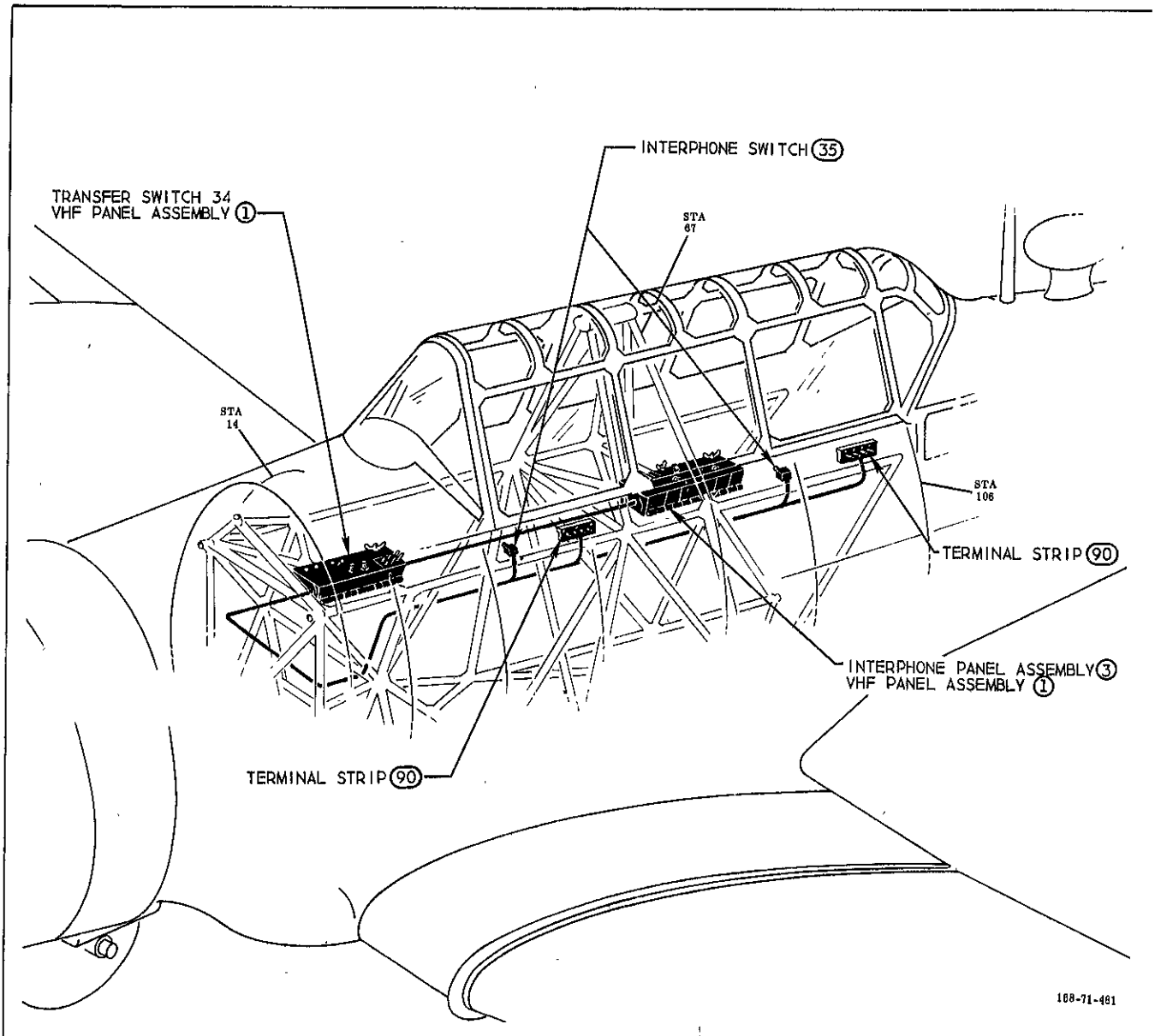
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
45	Jack - Combination Headset and Microphone	U-61/U
54	Plug	PL-Q-169
55	Plug	PL-Q-170
56	Plug	PL-Q-171
57	Plug	PL-Q-172
60	Plug	PL-259A
66	Adapter - Right-angle	M-359A
68	Socket	S306-CCT (H. B. Jones)
69	Adapter	PL-271
75	Antenna - VHF	AN104-B
81	Cable - Coaxial VHF	RG-8/U
90	Terminal Strip	NAS 45-6-( )
*228	Console - Forward Right-hand	168-54005 (NAA)

Figure 8-15 (Sheet 1 of 2 Sheets).



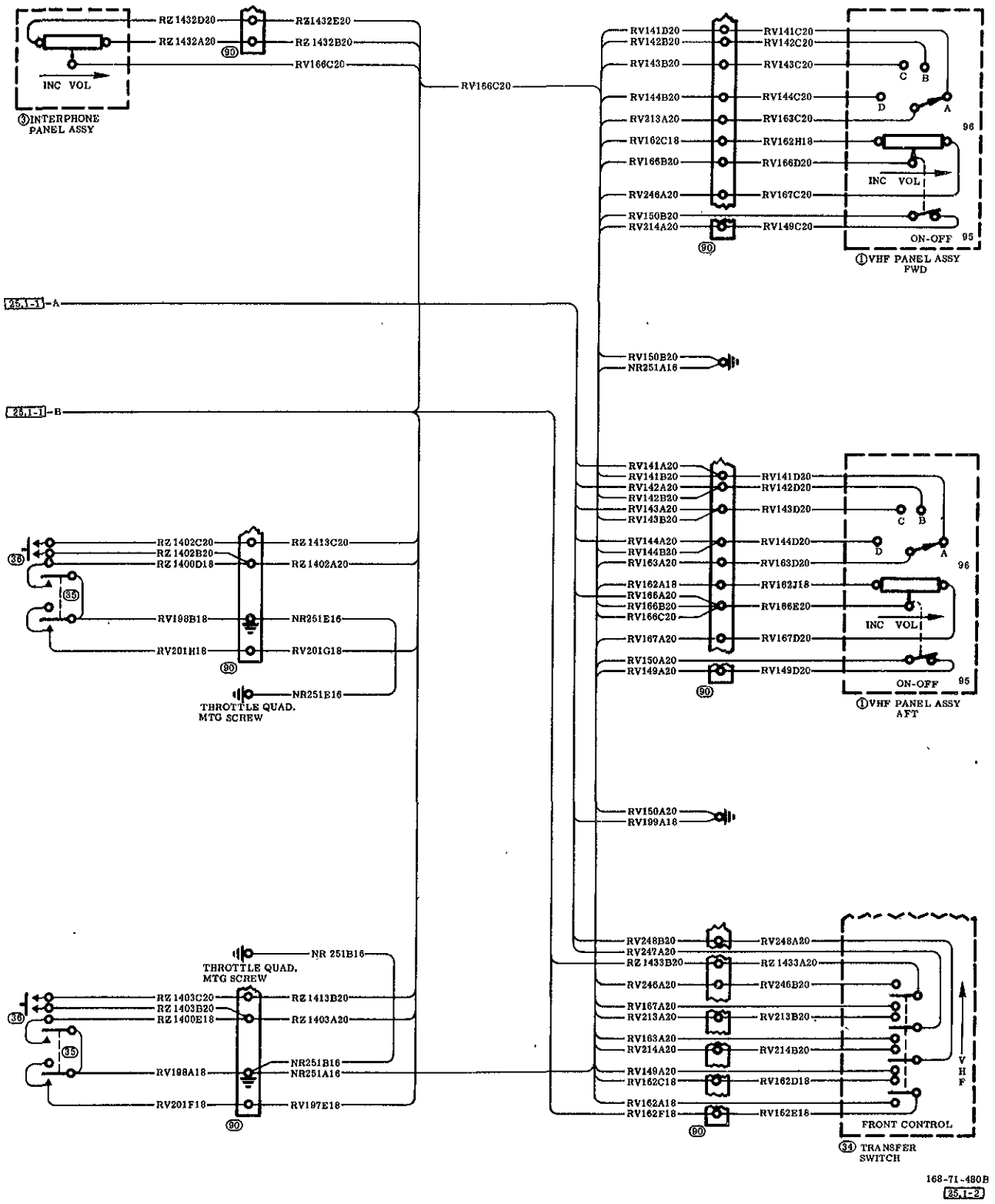
VHF and Interphone - Airplanes AF49-2897 Through AF49-2981

REVISED 25 FEBRUARY 1952

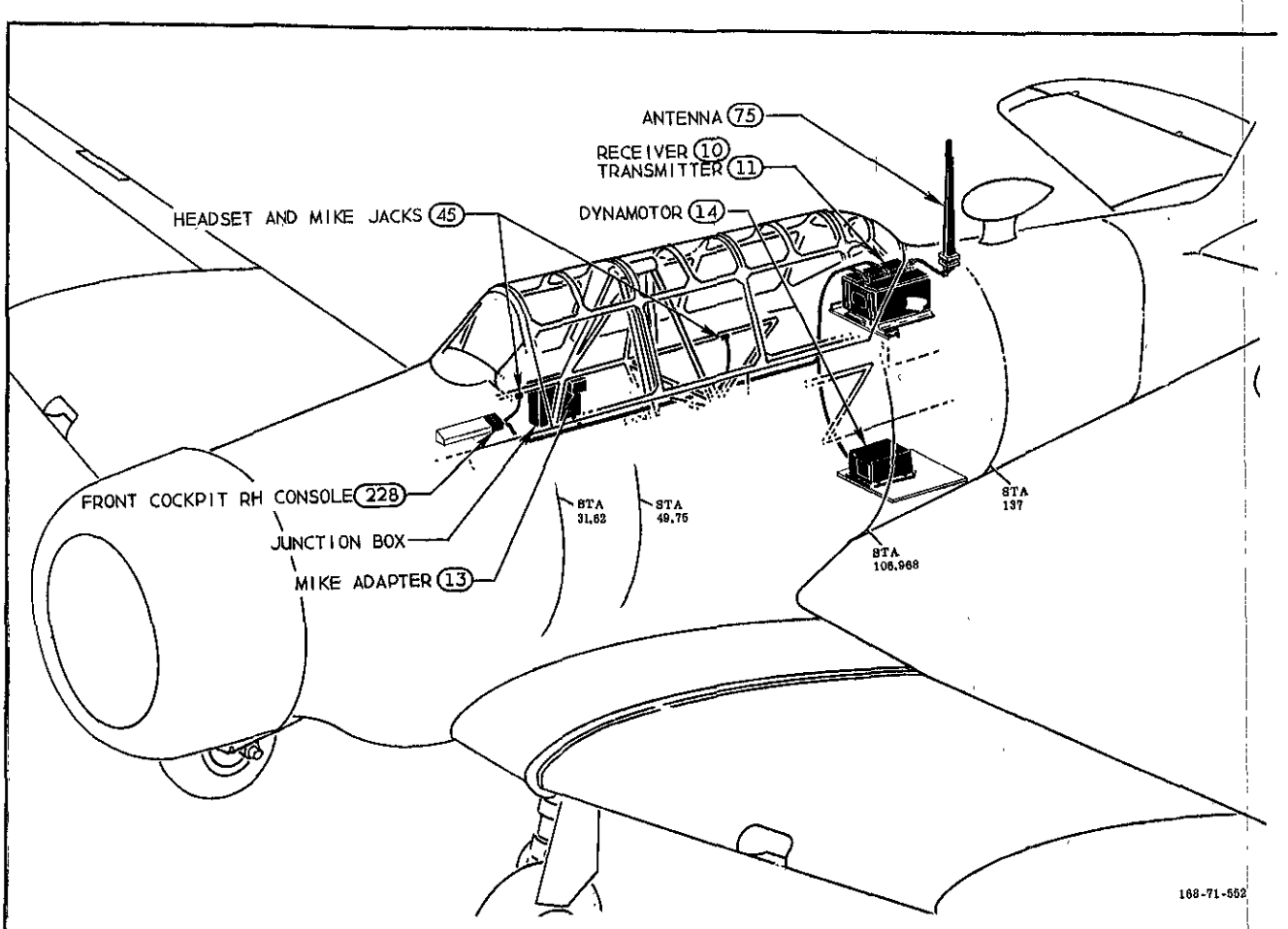


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel Assembly - VHF	168-71012 (NAA)
3	Panel Assembly - Interphone	168-71014 (NAA)
34	Switch - Transfer 4PDT	AN3227-3
35	Switch - Interphone	AN3023-6
36	Switch - Throttle	
90	Terminal Strip	NAS 45-6-( )
95	Control	V137
96	Switch - Selector	1401

Figure 8-15 (Sheet 2 of 2 Sheets).



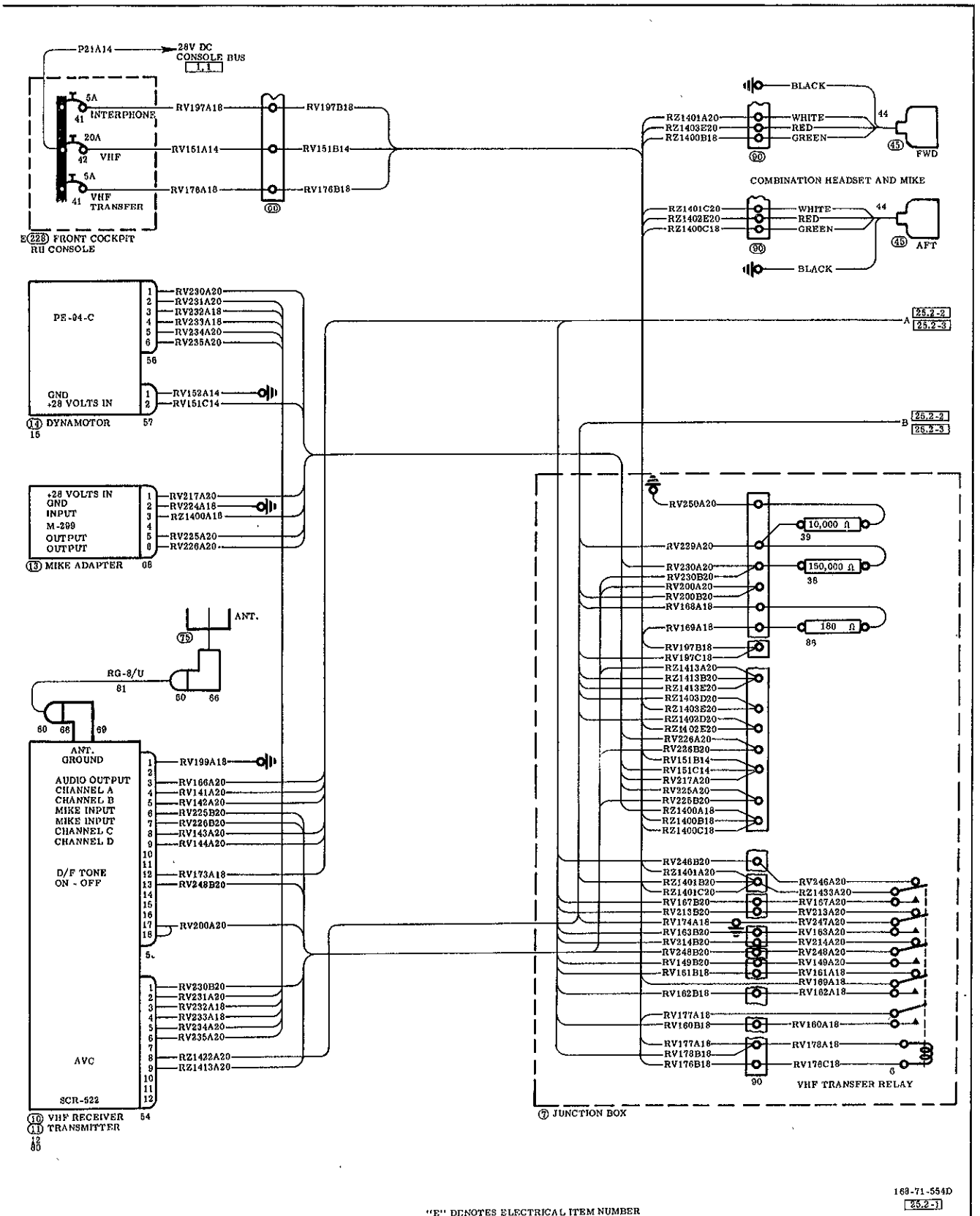
VHF and Interphone - Airplanes AF49-2897 Through AF49-2981



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
6	Relay - Interphone	
7	Junction Box	168-71021 (NAA)
10	Receiver - VHF	BC-624-C
11	Transmitter - VHF	BC-625-AM
12	Mounting - Receiver-Transmitter	FT-224-A
13	Adapter - Microphone	M-299
14	Dynamotor	PE-94C
15	Mounting - Dynamotor	FT-498
38	Resistor - 150,000-ohm 1/2-watt	168-71036-3 (NAA)
39	Resistor - 10,000-ohm 1/2-watt	168-71036 (NAA)
41	Circuit Breaker - 5-amp	AN3161-P5
42	Circuit Breaker - 20-amp	AN3161-P20
44	Cord - Headset and Microphone	WF-5/U
45	Jack - Combination Headset and Microphone	U-61/U
	* Electrical Item Number	

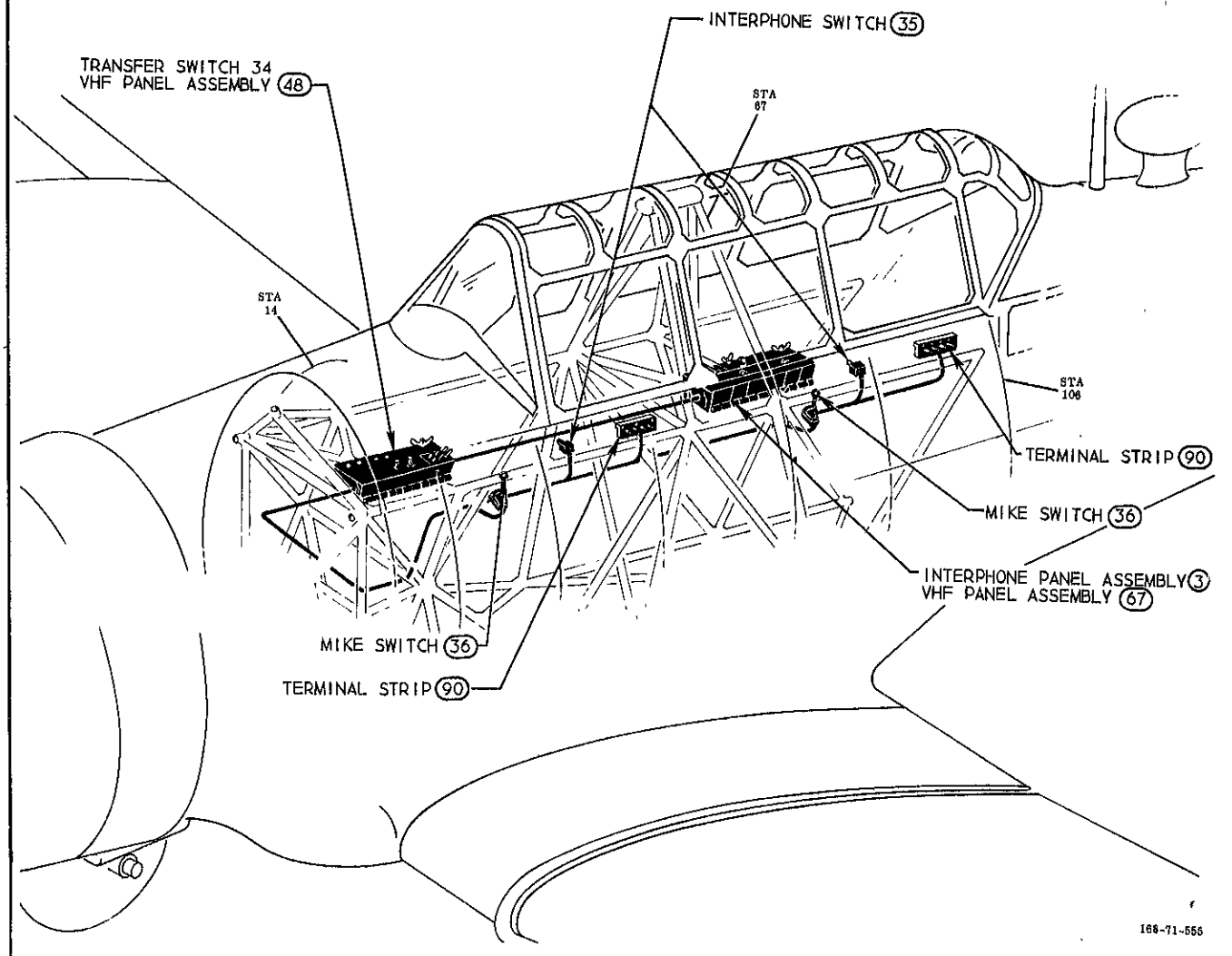
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
54	Plug	PL-Q-169
55	Plug	PL-Q-170
56	Plug	PL-Q-171
57	Plug	PL-Q-172
60	Plug	PL-259A
66	Adapter - Right-angle	M-359A
68	Socket	S306-CCT (H.B. Jones)
69	Adapter	PL-271
75	Antenna - VHF	AN104-B
80	Rack - VHF Transmitter-Receiver	FT-244-A
81	Cable - Coaxial VHF	RG-8/U
86	Resistor - 180-ohm 1/2-watt	168-71036-5 (NAA)
90	Terminal Strip	NAS 45-6-( ) -
*228	Console - Forward Right-hand	168-54005-20 (NAA)

Figure 8-16. VHF and Interphone - Airplanes AF49-2982 Through AF49-3537, AF50-1277



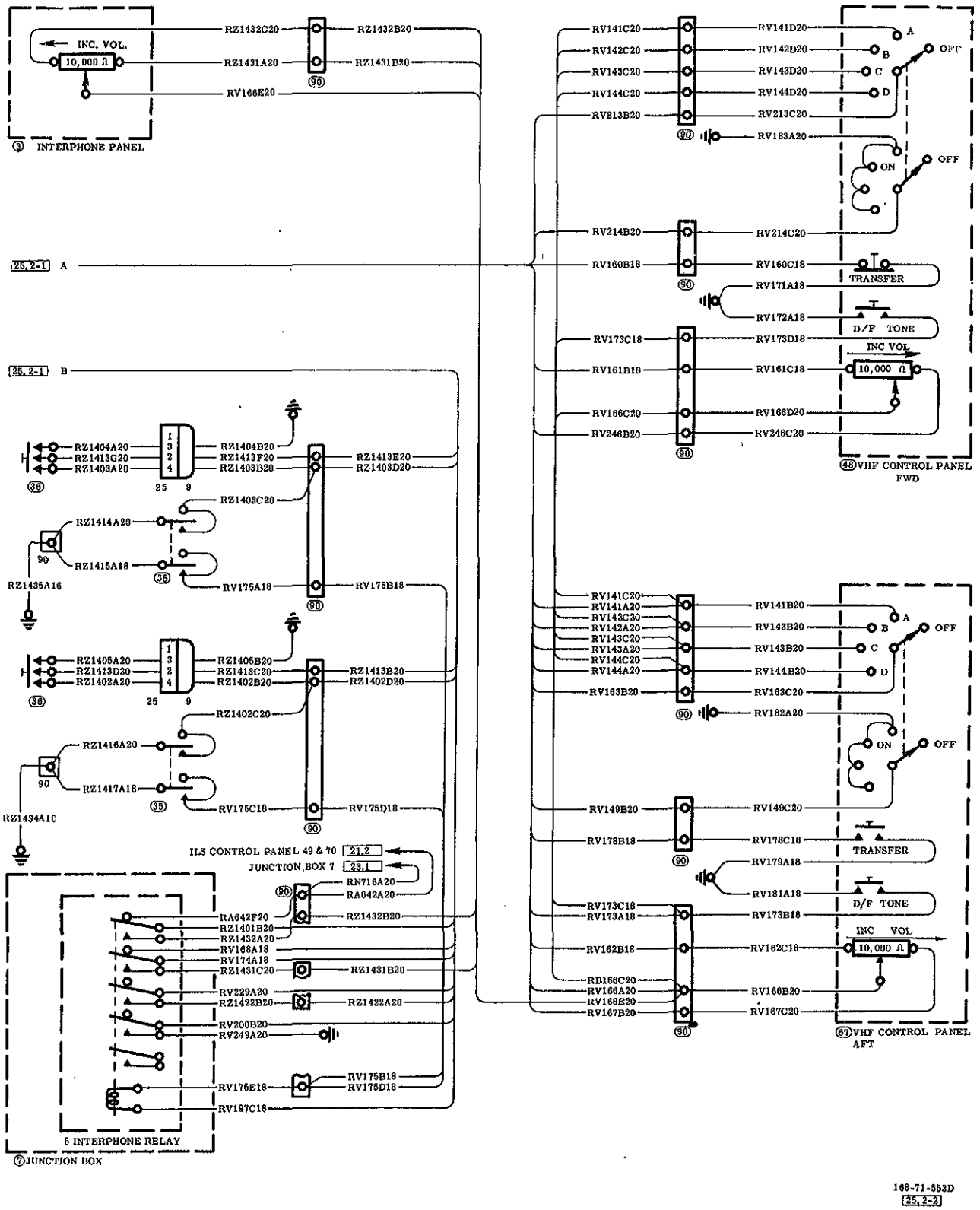
"E" DENOTES ELECTRICAL ITEM NUMBER

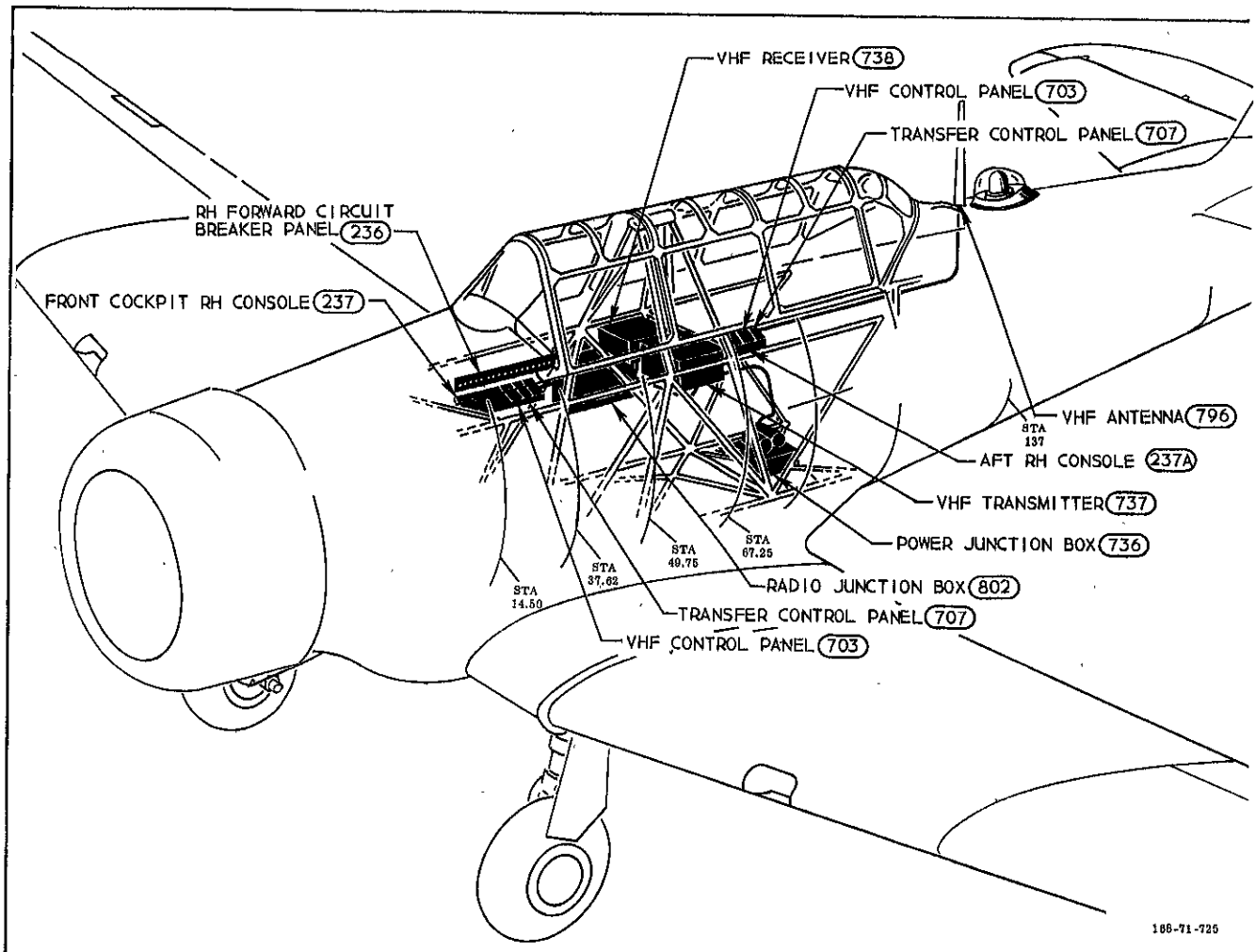
168-71-554D
25.2-1



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
3	Panel Assembly - Interphone	168-71014 (NAA)
6	Relay - Interphone	182ADX57 (Struthers Dunn)
7	Junction Box	168-71021 (NAA)
9	Plug	PL-108
25	Receptacle	
35	Switch - Interphone	AN3023-6
36	Switch - Throttle	
48	Panel - VHF Forward	168-71061-10 (NAA)
49	Panel Assembly - Forward ILS	168-71063-10 (NAA)
67	Panel - VHF Aft	168-71061 (NAA)
70	Panel Assembly - AFT ILS	168-71063 (NAA)
90	Terminal Strip	NAS 45-6-( )

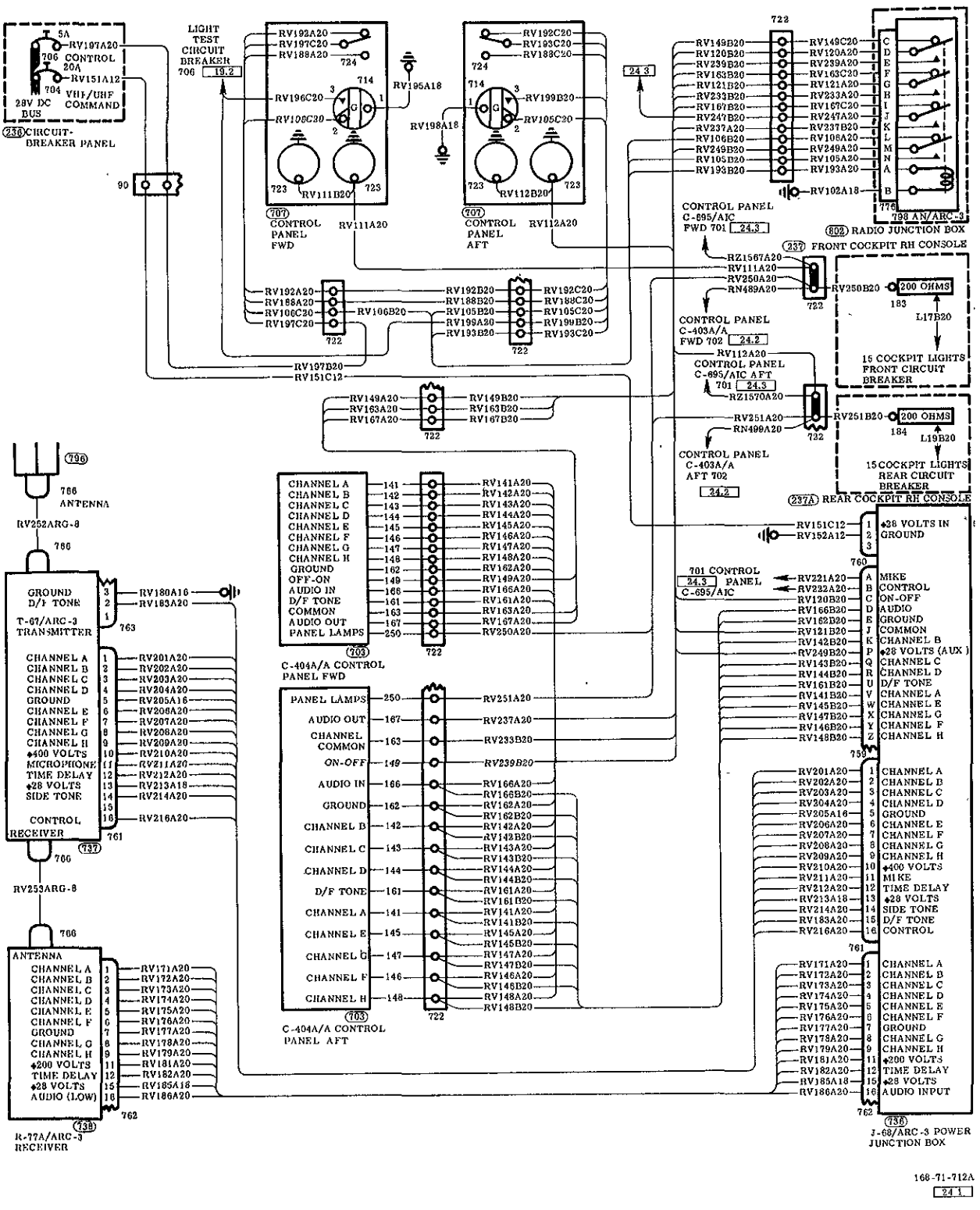
Figure 8-16A. VHF and Interphone - Airplanes AF49-2982 Through AF49-3044, AF49-3087 Through AF49-3537,

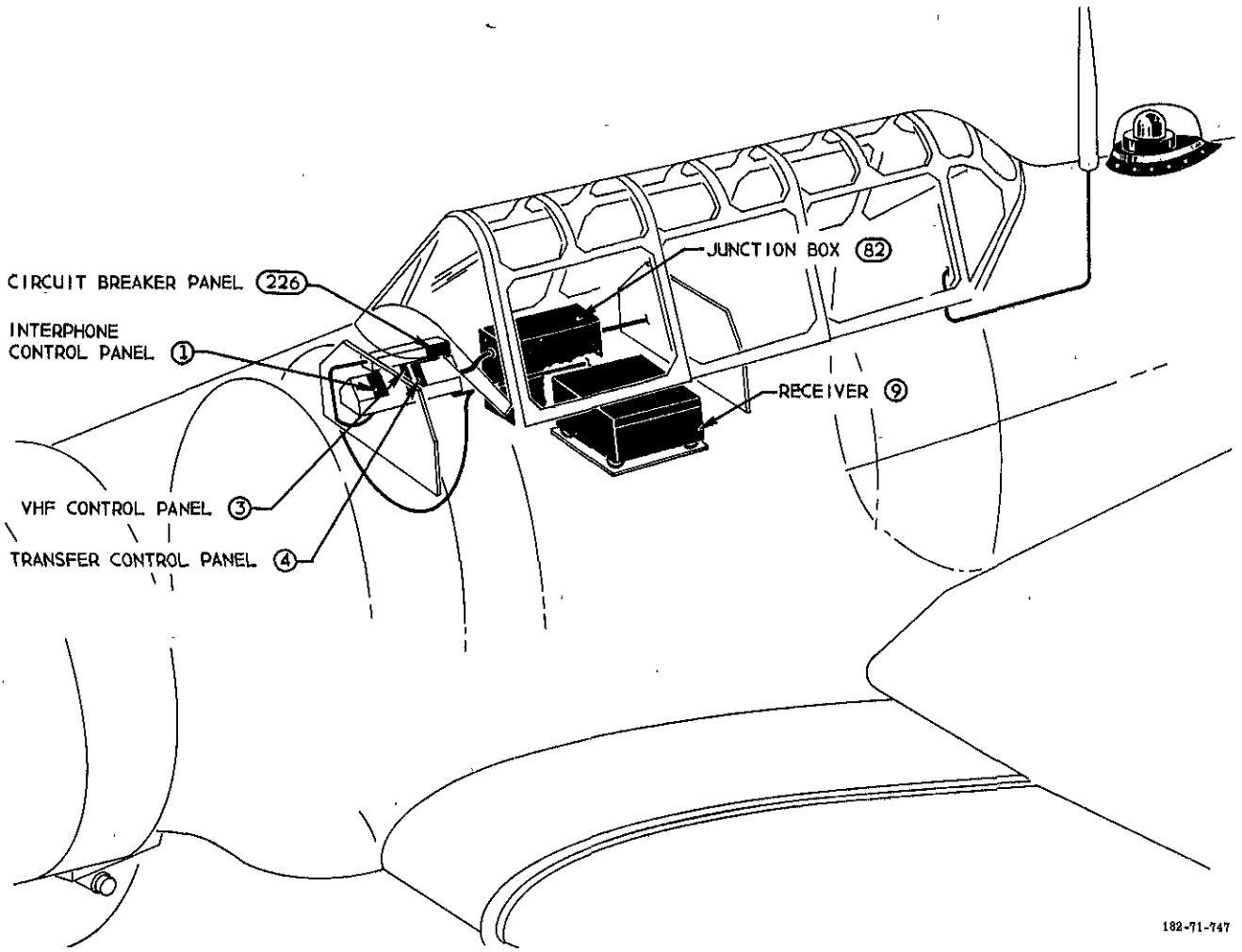

INC. VOL.
10,000 Ω
RZ1432C20
RZ1431A20
RV166E20
RZ1432B20
RZ1431B20
③ INTERPHONE PANEL
25, 2-1 A
25, 2-1 B
RV141C20
RV142C20
RV143C20
RV144C20
RV213B20
RV141D20
RV142D20
RV143D20
RV144D20
RV213C20
RV163A20
A
B
C
D
OFF
ON
OFF
RV214B20
RV160B18
RV214C20
RV160C18
TRANSFER
RV171A18
RV172A18
D/F TONE
RV173C18
RV161B18
RV166C20
RV246B20
RV173D18
RV161C18
RV166D20
RV246C20
INC VOL
10,000 Ω
48 VHF CONTROL PANEL FWD
RZ1404A20
RZ1413G20
RZ1403A20
RZ1404B20
RZ1413F20
RZ1403B20
RZ1413E20
RZ1403D20
RZ1403C20
RZ1414A20
RZ1415A18
RZ1435A16
RV175A18
RV175B18
RZ1405A20
RZ1413D20
RZ1402A20
RZ1405B20
RZ1413C20
RZ1402B20
RZ1413B20
RZ1402D20
RZ1402C20
RZ1416A20
RZ1417A18
RZ1434A16
RV175C18
RV175D18
RV141C20
RV141A20
RV143C20
RV142A20
RV143C20
RV143A20
RV144C20
RV144A20
RV163B20
RV141B20
RV142B20
RV143B20
RV144B20
RV163C20
RV182A20
RV149B20
RV178B18
RV173C18
RV173A18
RV162B18
RV166A20
RV166E20
RV167B20
RV149C20
RV178C18
RV179A18
RV181A18
RV173B18
RV162C18
RV166B20
RV167C20
67 VHF CONTROL PANEL AFT
ILS CONTROL PANEL 49 & 70 21.2
JUNCTION BOX 7 23.1
RN716A20
RA642A20
RA642F20
RZ1401B20
RZ1432A20
RV168A18
RV174A18
RZ1431C20
RZ1431B20
RV229A20
RZ1422B20
RZ1422A20
RV200B20
RV249A20
RV175E18
RV197C18
RV175B18
RV175D18
6 INTERPHONE RELAY
⑦ JUNCTION BOX
168-71-553D
25, 2-3



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
90	Terminal Strip	NAS45-6
183	Rheostat - Front Cockpit Lights	AN3155-25-200
184	Rheostat - Rear Cockpit Lights	AN3155-25-200
237	Console - Forward Right-hand	168-54063 (NAA)
237A	Console - Aft Right-hand	
703	Panel - VHF Control	C-404/A
707	Panel - Transfer Control	171-71028 (NAA)
714	Light Assembly	AN3157-3
722	Terminal Strip	NAS45-6
723	Light Assembly	AN3502-2A
724	Switch	AN3021-9
737	Transmitter - VHF	T-67/ARC-3
738	Receiver - VHF	R-77A/ARC-3
759	Plug	U-16/U
760	Plug	PL-148-A
761	Plug	U-15/U
762	Plug	PL-153-A
763	Plug	PL-151-A
766	Plug	PL-259-A
776	Receptacle	AN3102M-20-27S
796	Antenna - VHF/UHF	AN-104-B
798	Relay	8979-1A

Figure 8-17. AN/ARC-3 Radio -

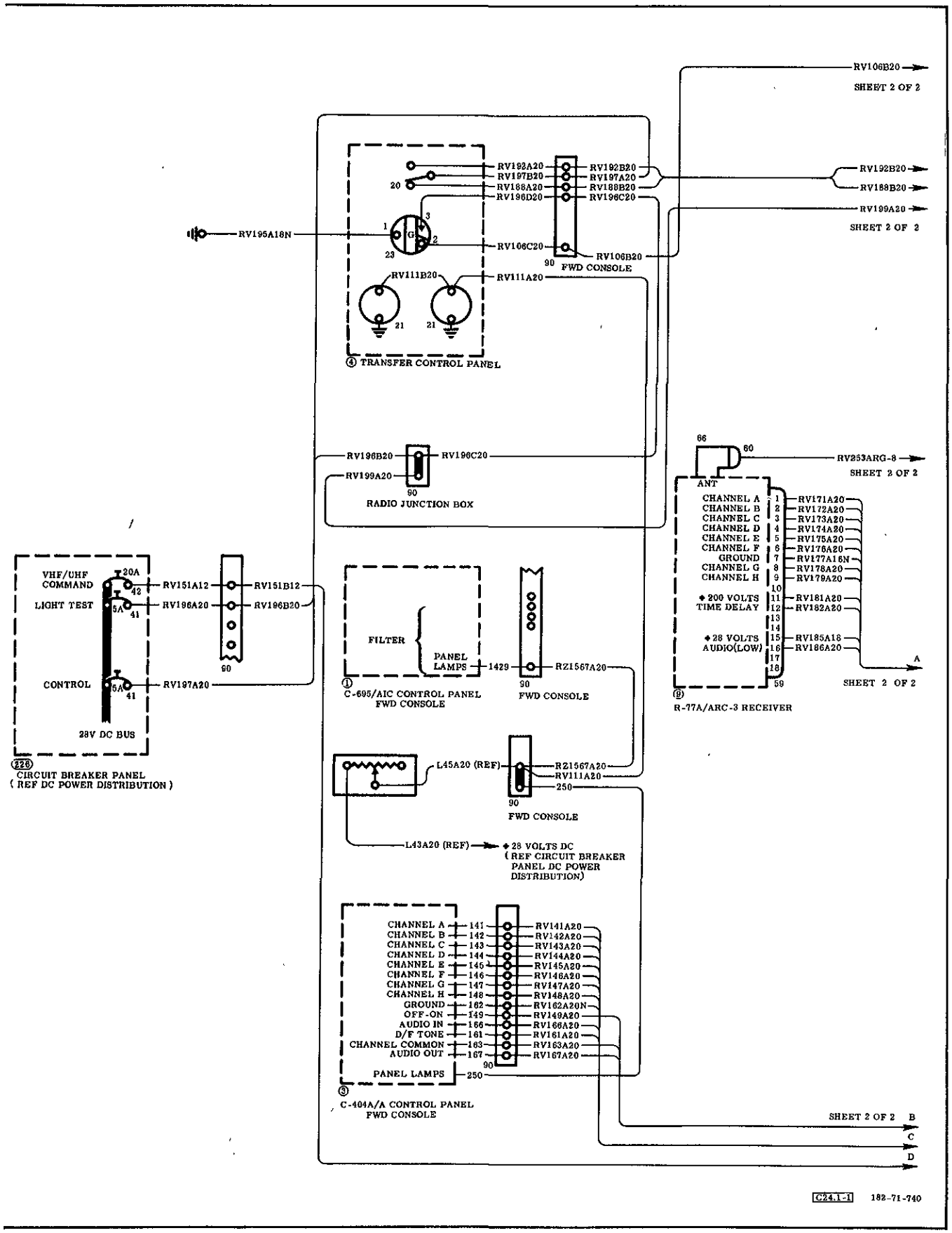

5A
RV197A20
706 CONTROL
20A
RV151A12
704 VHF/UHF COMMAND
28V DC BUS
236 CIRCUIT-BREAKER PANEL
LIGHT TEST CIRCUIT BREAKER 706 19.2
RV192A20
RV197C20
RV188A20
724
RV196C20
RV108C20
RV111B20
RV111A20
RV195A18
RV198A18
RV192C20
RV193C20
RV188C20
RV199B20
RV105C20
RV112B20
RV112A20
707 CONTROL PANEL AFT
701 CONTROL PANEL FWD
90
722
RV149B20
RV120B20
RV239B20
RV163B20
RV121B20
RV233B20
RV167B20
RV247B20
RV237A20
RV106B20
RV249B20
RV105B20
RV193B20
RV149C20
RV120A20
RV239A20
RV163C20
RV121A20
RV233A20
RV167C20
RV247A20
RV237B20
RV106A20
RV249A20
RV105A20
RV193A20
RV102A18
776 798 AN/ARC-3
802 RADIO JUNCTION BOX
24.3
CONTROL PANEL C-695/AIC FWD 701 24.3
237 FRONT COCKPIT RH CONSOLE
RZ1567A20
RV111A20
RV250A20
RN489A20
RV250B20
200 OHMS
183
L17B20
15 COCKPIT LIGHTS FRONT CIRCUIT BREAKER
CONTROL PANEL C-403A/A FWD 702 24.2
RV112A20
CONTROL PANEL C-695/AIC AFT 701 24.3
RZ1570A20
RV251A20
RN490A20
RV251B20
200 OHMS
184
L19B20
15 COCKPIT LIGHTS REAR CIRCUIT BREAKER
CONTROL PANEL C-403A/A AFT 702 24.2
237A REAR COCKPIT RH CONSOLE
RV192A20
RV188A20
RV106C20
RV197C20
RV106B20
RV192B20
RV188B20
RV105B20
RV199A20
RV193B20
RV192C20
RV188C20
RV105C20
RV199B20
RV193C20
RV197B20
RV151C12
RV149A20
RV163A20
RV167A20
RV149B20
RV163B20
RV167B20
RV151C12
RV152A12
+28 VOLTS IN
GROUND
760
796
786 ANTENNA
RV252ARG-8
786
GROUND
D/F TONE
T-67/ARC-3 TRANSMITTER
763
RV180A16
RV183A20
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
GROUND
CHANNEL E
CHANNEL F
CHANNEL G
CHANNEL H
+400 VOLTS
MICROPHONE
TIME DELAY
+28 VOLTS
SIDE TONE
CONTROL
RECEIVER
761
737
RV201A20
RV202A20
RV203A20
RV204A20
RV205A16
RV206A20
RV207A20
RV208A20
RV209A20
RV210A20
RV211A20
RV212A20
RV213A18
RV214A20
RV216A20
CHANNEL A 141 RV141A20
CHANNEL B 142 RV142A20
CHANNEL C 143 RV143A20
CHANNEL D 144 RV144A20
CHANNEL E 145 RV145A20
CHANNEL F 146 RV146A20
CHANNEL G 147 RV147A20
CHANNEL H 148 RV148A20
GROUND 162 RV162A20
OFF-ON 149 RV149A20
AUDIO IN 166 RV166A20
D/F TONE 161 RV161A20
COMMON 163 RV163A20
AUDIO OUT 167 RV167A20
PANEL LAMPS 250 RV250A20
703 C-404A/A CONTROL PANEL FWD
722
701 CONTROL PANEL C-695/AIC 24.3
RV221A20
RV222A20
RV120B20
RV166B20
RV162B20
RV121B20
RV142B20
RV249B20
RV143B20
RV144B20
RV161B20
RV141B20
RV145B20
RV147B20
RV146B20
RV148B20
MIKE
CONTROL
ON-OFF
AUDIO
GROUND
COMMON
CHANNEL B
+28 VOLTS (AUX)
CHANNEL C
CHANNEL D
D/F TONE
CHANNEL A
CHANNEL E
CHANNEL G
CHANNEL F
CHANNEL H
759
PANEL LAMPS 250 RV251A20
AUDIO OUT 167 RV237A20
CHANNEL COMMON 163 RV233B20
ON-OFF 149 RV239B20
AUDIO IN 166 RV166A20 RV166B20
GROUND 162 RV162A20 RV162B20
CHANNEL B 142 RV142A20 RV142B20
CHANNEL C 143 RV143A20 RV143B20
CHANNEL D 144 RV144A20 RV144B20
D/F TONE 161 RV161A20 RV161B20
CHANNEL A 141 RV141A20 RV141B20
CHANNEL E 145 RV145A20 RV145B20
CHANNEL G 147 RV147A20 RV147B20
CHANNEL F 146 RV146A20 RV146B20
CHANNEL H 148 RV148A20 RV148B20
703 C-404A/A CONTROL PANEL AFT
722
RV201A20
RV202A20
RV203A20
RV204A20
RV205A16
RV206A20
RV207A20
RV208A20
RV209A20
RV210A20
RV211A20
RV212A20
RV213A18
RV214A20
RV183A20
RV216A20
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
GROUND
CHANNEL E
CHANNEL F
CHANNEL G
CHANNEL H
+400 VOLTS
MIKE
TIME DELAY
+28 VOLTS
SIDE TONE
D/F TONE
CONTROL
761
766
RV253ARG-8
766
ANTENNA
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
CHANNEL E
CHANNEL F
GROUND
CHANNEL G
CHANNEL H
+200 VOLTS
TIME DELAY
+28 VOLTS
AUDIO (LOW)
762
738
R-77A/ARC-3 RECEIVER
RV171A20
RV172A20
RV173A20
RV174A20
RV175A20
RV176A20
RV177A20
RV178A20
RV179A20
RV181A20
RV182A20
RV185A18
RV186A20
RV171A20
RV172A20
RV173A20
RV174A20
RV175A20
RV176A20
RV177A20
RV178A20
RV179A20
RV181A20
RV182A20
RV185A18
RV186A20
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
CHANNEL E
CHANNEL F
GROUND
CHANNEL G
CHANNEL H
+200 VOLTS
TIME DELAY
+28 VOLTS
AUDIO INPUT
762
736
J-68/ARC-3 POWER JUNCTION BOX
168-71-712A
24.1



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Interphone Control	C-695/AIC
3	Panel - VHF Control	C-404A/A
4	Panel - Transfer Control	171-71028-11
9	Receiver - VHF	R-77A/ARC-3
20	Switch	AN3021-3
21	Light Assembly	AN3052-2A
23	Light Assembly	AN3157-3
41	Circuit Breaker	AN3161-P5
42	Circuit Breaker	AN3161-P20
59	Plug	PL-153-A
60	Plug	PL-259-A
66	Adapter - Right Angle	M-359A
90	Terminal Strip	NAS45-6-( )
*226	Panel - Circuit Breaker	182-54027

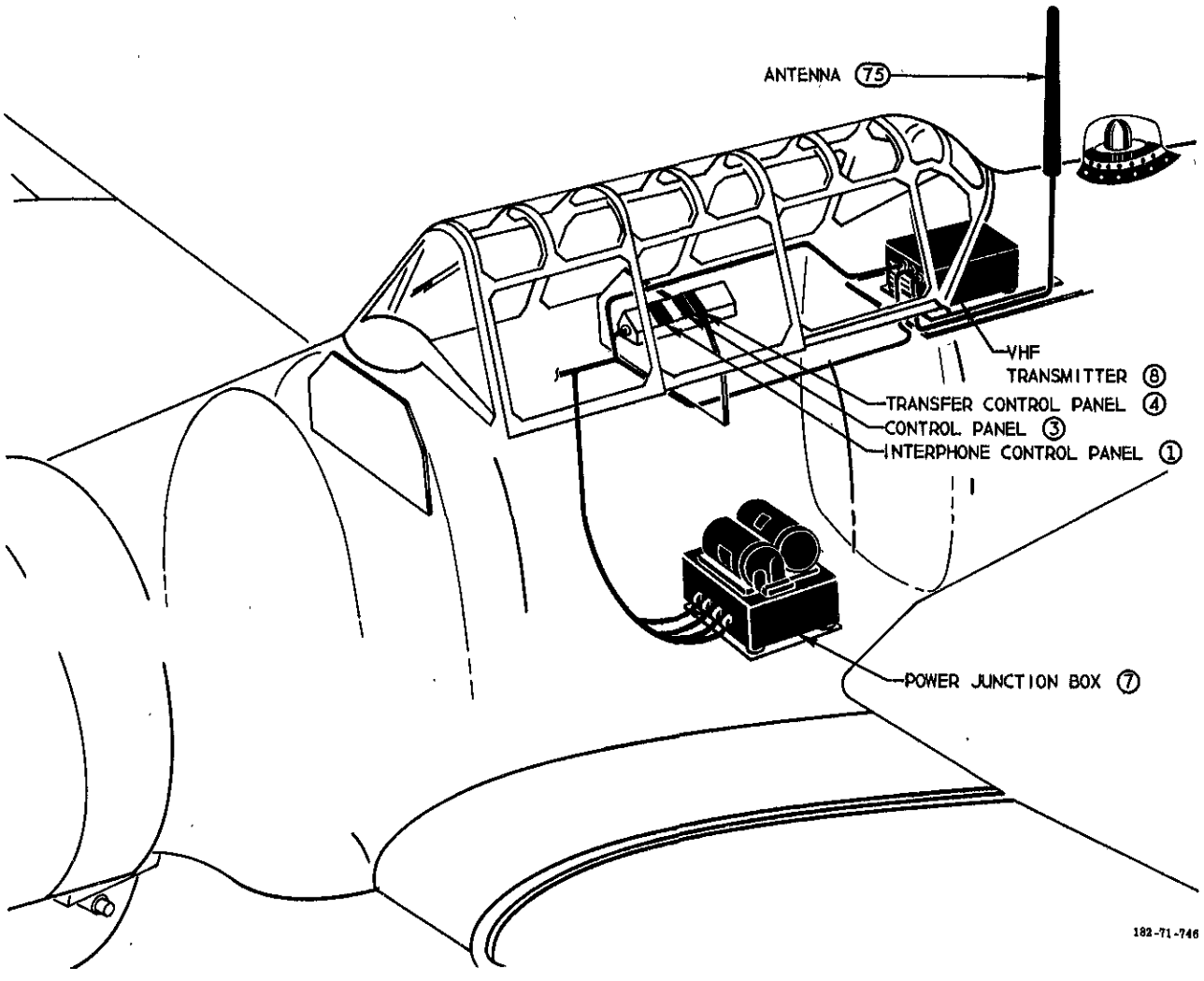
*Electrical Item Number

Figure 8-17A (Sheet 1 of 2 Sheets). AN/ARC-3 Radio - Airplanes



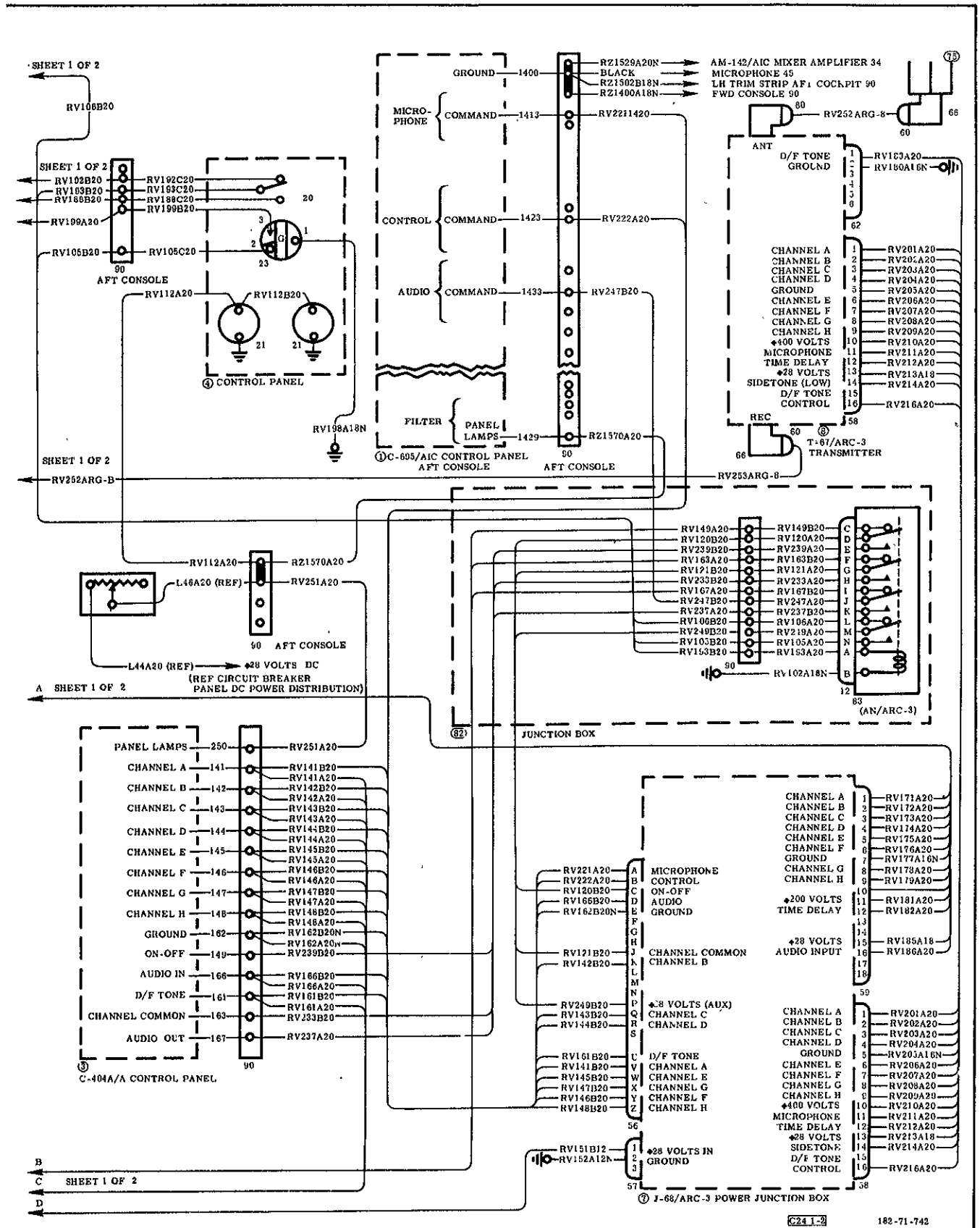
AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent

REVISED 25 JUNE 1953

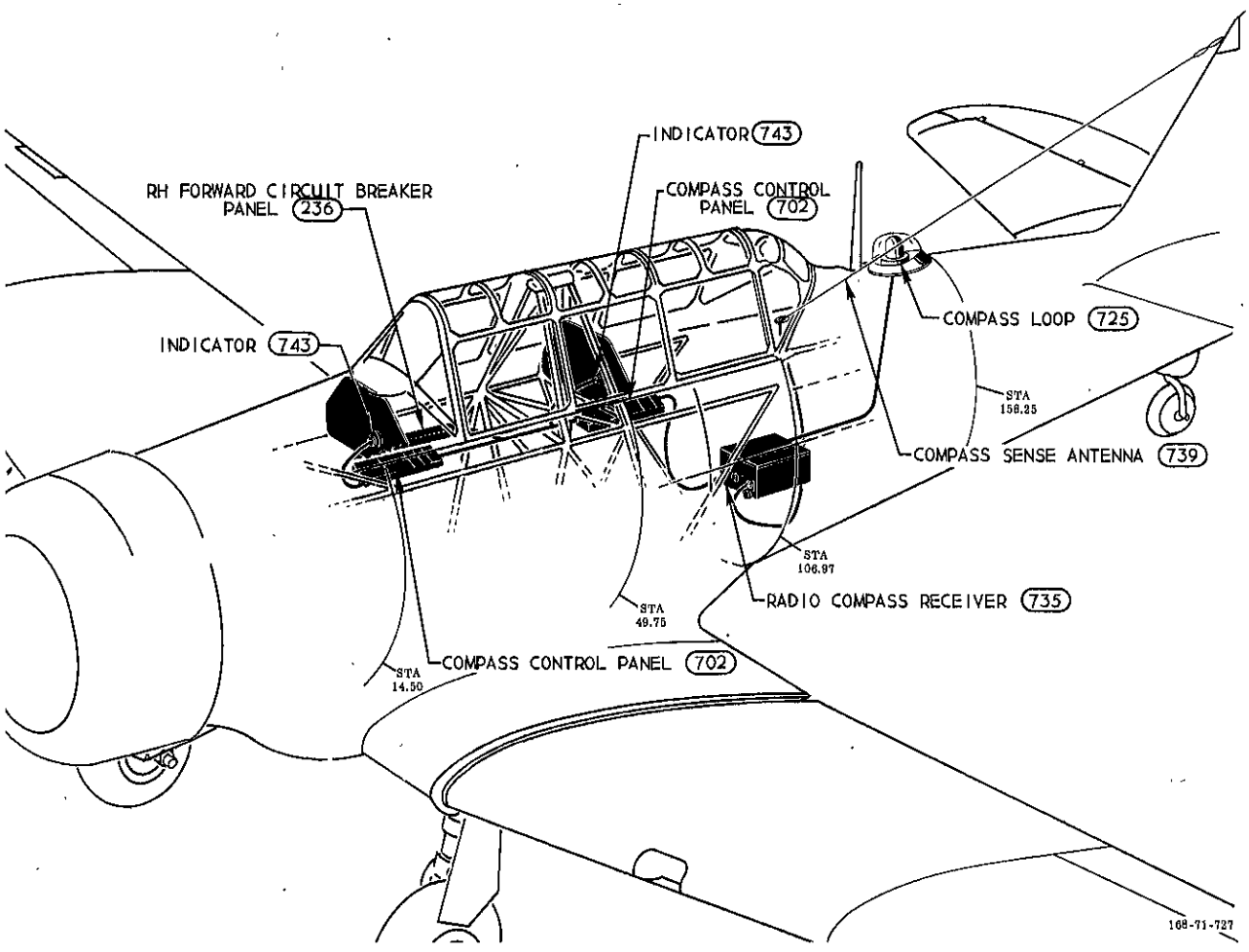


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Interphone Control	C-695/AIC
3	Panel - VHF Control	C-404A/A
4	Panel - Transfer Control	171-71028-11
7	Junction Box - Power	J-68/ARC-3
8	Transmitter - VHF	T-67/ARC-3
12	Receptacle	AN3102M-20-27S
20	Switch	AN3021-3
21	Light Assembly	AN3052-2A
23	Light Assembly	AN3157-3
57	Plug	PL-148A
58	Plug	U-15/U
59	Plug	PL-153-A
60	Plug	PL-259-A
62	Plug	PL-151-A
66	Adapter - Right Angle	M-359A
75	Antenna - VHF/UHF	AN104-B
82	Junction Box	168-71078-10
83	Relay	8979-1A
90	Terminal Strip	NAS45-6-( )

Figure 8-17A (Sheet 2 of 2 Sheets). AN/ARC-3 Radio - Airplanes

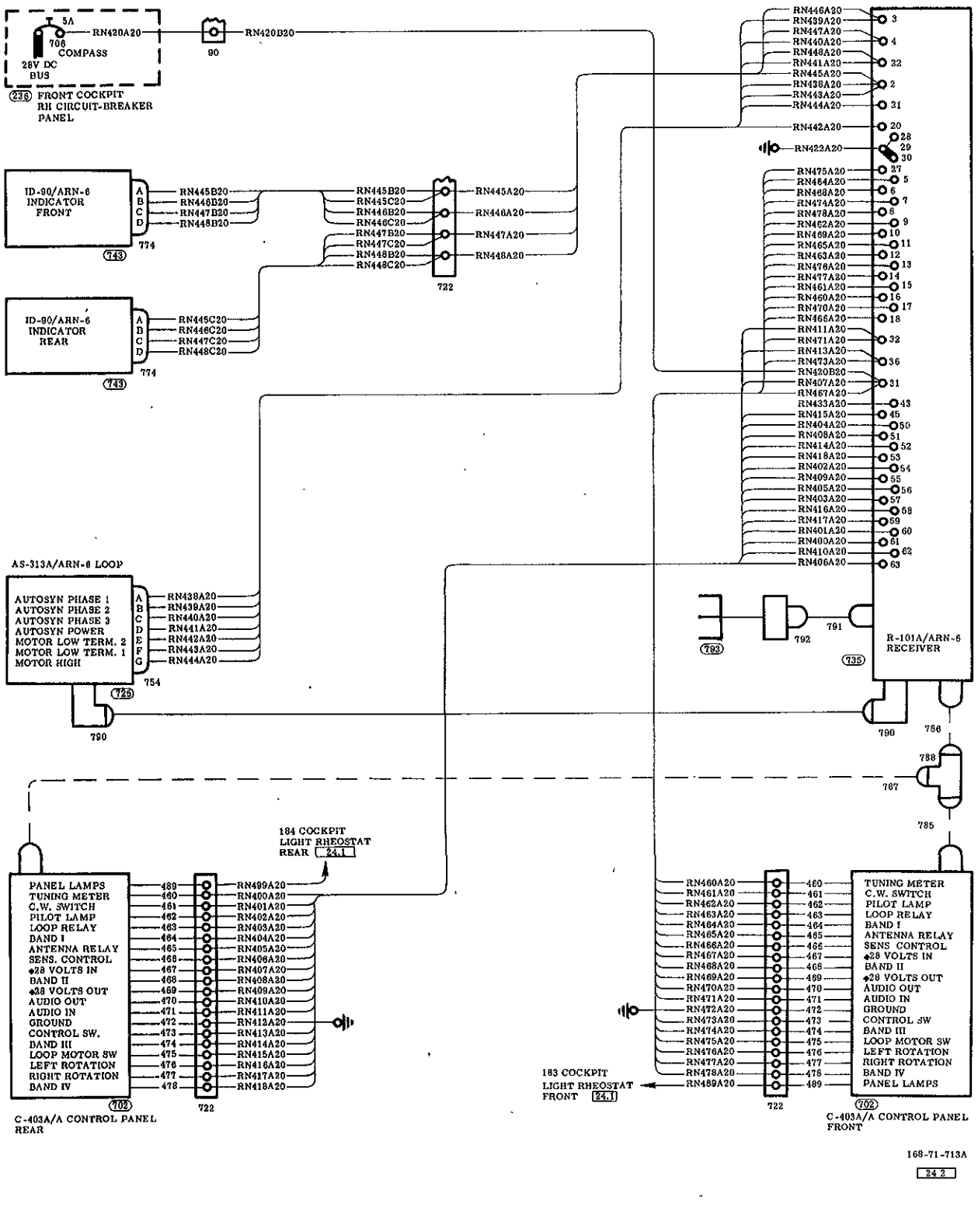


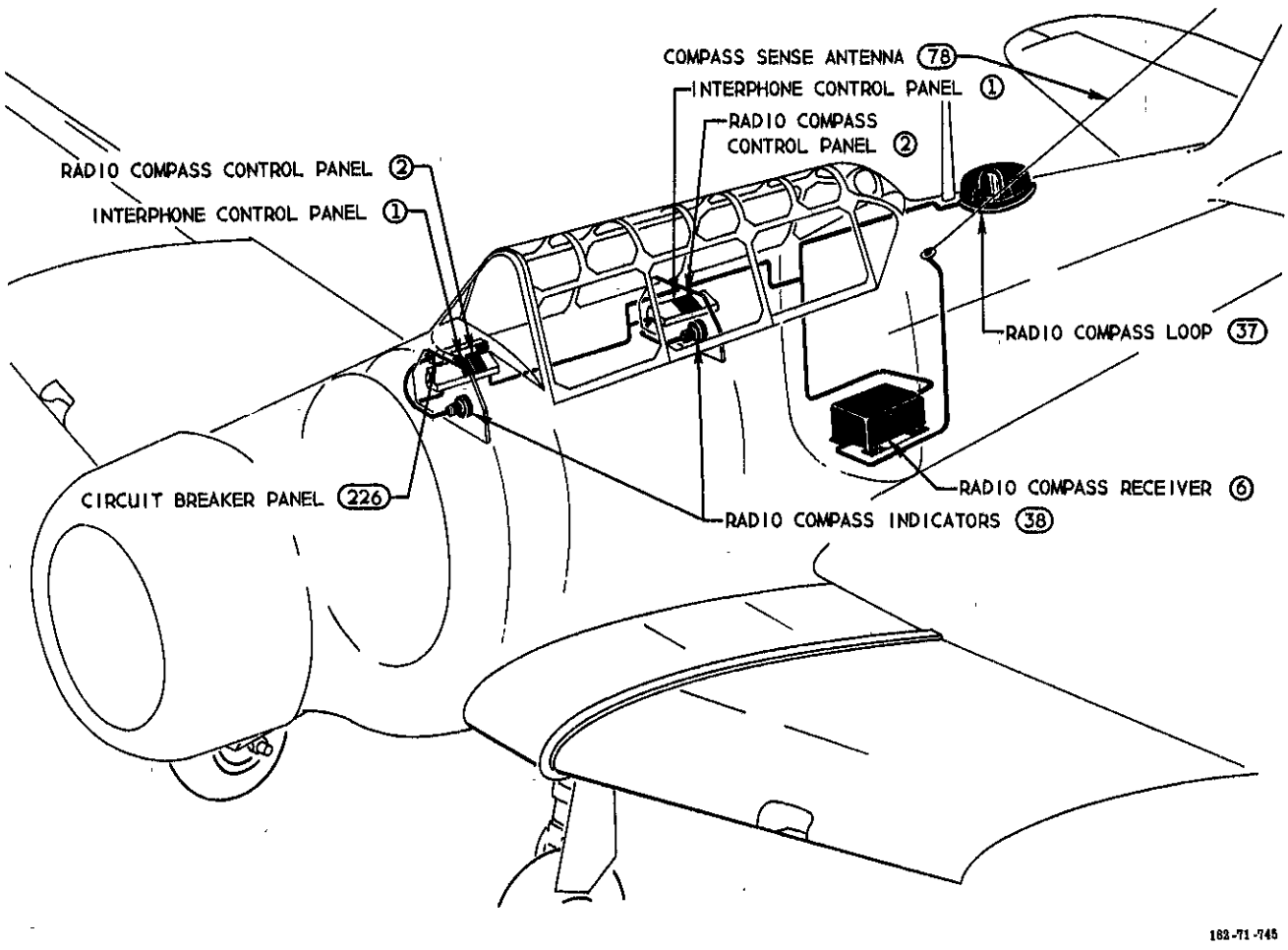
AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
702	Panel - Compass Control	C-403A/A, 159-71064
722	Terminal Strip	NAS45-6
725	Compass Loop	AS313A/ARN-6
734	Mounting - Compass Receiver	MT-273B/ARN-6
743	Indicator	ID-90/ARN-6
754	Plug	AN3108B-16S-1S
774	Plug	AN3106A-14S-2S
785	Tuning Shaft - Front Console	LA-1564-36
786	Tuning Shaft - Rear Console	LA-1564-134
787	Tuning Shaft - Rear Console	LA-1564-39
788	Coupling - Tuning Shaft Tee	MC-203-A
790	Loop Cord	CG-132/ARN-6
791	Cord - Sense Antenna	CG-405/ARN-6
792	Coupling Unit	CU-65/ARN-6
793	Antenna - Compass Sense	W-106-A

Figure 8-18. AN/ARN-6 Radio -

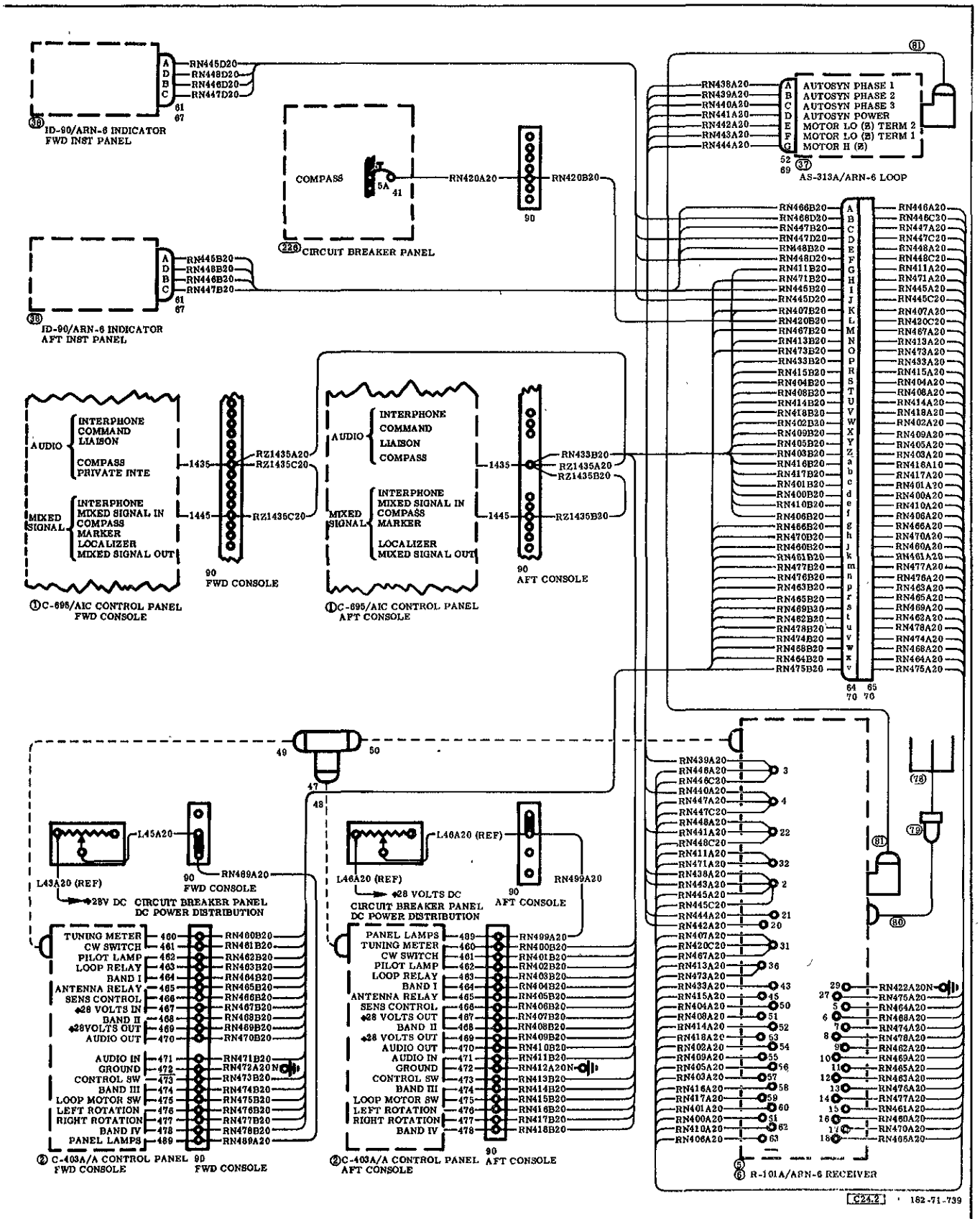

5A
706
COMPASS
28V DC BUS
RN420A20
90
RN420D20
236 FRONT COCKPIT RH CIRCUIT-BREAKER PANEL
ID-90/ARN-6 INDICATOR FRONT
743
774
RN445B20
RN446B20
RN447B20
RN448B20
RN445C20
RN446C20
RN447C20
RN448C20
RN445A20
RN446A20
RN447A20
RN448A20
722
ID-90/ARN-6 INDICATOR REAR
RN445C20
RN446C20
RN447C20
RN448C20
AS-313A/ARN-6 LOOP
AUTOSYN PHASE 1
AUTOSYN PHASE 2
AUTOSYN PHASE 3
AUTOSYN POWER
MOTOR LOW TERM. 2
MOTOR LOW TERM. 1
MOTOR HIGH
RN438A20
RN439A20
RN440A20
RN441A20
RN442A20
RN443A20
RN444A20
754
726
790
R-101A/ARN-6 RECEIVER
735
791
792
793
786
787
788
785
184 COCKPIT LIGHT RHEOSTAT REAR 24.1
PANEL LAMPS
TUNING METER
C.W. SWITCH
PILOT LAMP
LOOP RELAY
BAND I
ANTENNA RELAY
SENS. CONTROL
+28 VOLTS IN
BAND II
+28 VOLTS OUT
AUDIO OUT
AUDIO IN
GROUND
CONTROL SW.
BAND III
LOOP MOTOR SW
LEFT ROTATION
RIGHT ROTATION
BAND IV
RN499A20
RN400A20
RN401A20
RN402A20
RN403A20
RN404A20
RN405A20
RN406A20
RN407A20
RN408A20
RN409A20
RN410A20
RN411A20
RN412A20
RN413A20
RN414A20
RN415A20
RN416A20
RN417A20
RN418A20
702
C-403A/A CONTROL PANEL REAR
183 COCKPIT LIGHT RHEOSTAT FRONT 24.1
RN460A20
RN461A20
RN462A20
RN463A20
RN464A20
RN465A20
RN466A20
RN467A20
RN468A20
RN469A20
RN470A20
RN471A20
RN472A20
RN473A20
RN474A20
RN475A20
RN476A20
RN477A20
RN478A20
RN489A20
TUNING METER
C.W. SWITCH
PILOT LAMP
LOOP RELAY
BAND I
ANTENNA RELAY
SENS. CONTROL
+28 VOLTS IN
BAND II
+28 VOLTS OUT
AUDIO OUT
AUDIO IN
GROUND
CONTROL SW
BAND III
LOOP MOTOR SW
LEFT ROTATION
RIGHT ROTATION
BAND IV
PANEL LAMPS
C-403A/A CONTROL PANEL FRONT
RN446A20
RN439A20
RN447A20
RN440A20
RN448A20
RN441A20
RN445A20
RN438A20
RN443A20
RN444A20
RN442A20
RN422A20
RN475A20
RN464A20
RN468A20
RN474A20
RN478A20
RN462A20
RN469A20
RN465A20
RN463A20
RN476A20
RN477A20
RN461A20
RN460A20
RN470A20
RN466A20
RN411A20
RN471A20
RN413A20
RN473A20
RN420B20
RN407A20
RN467A20
RN433A20
RN415A20
RN404A20
RN408A20
RN414A20
RN418A20
RN402A20
RN409A20
RN405A20
RN403A20
RN416A20
RN417A20
RN401A20
RN400A20
RN410A20
RN406A20
168-71-713A
24.2

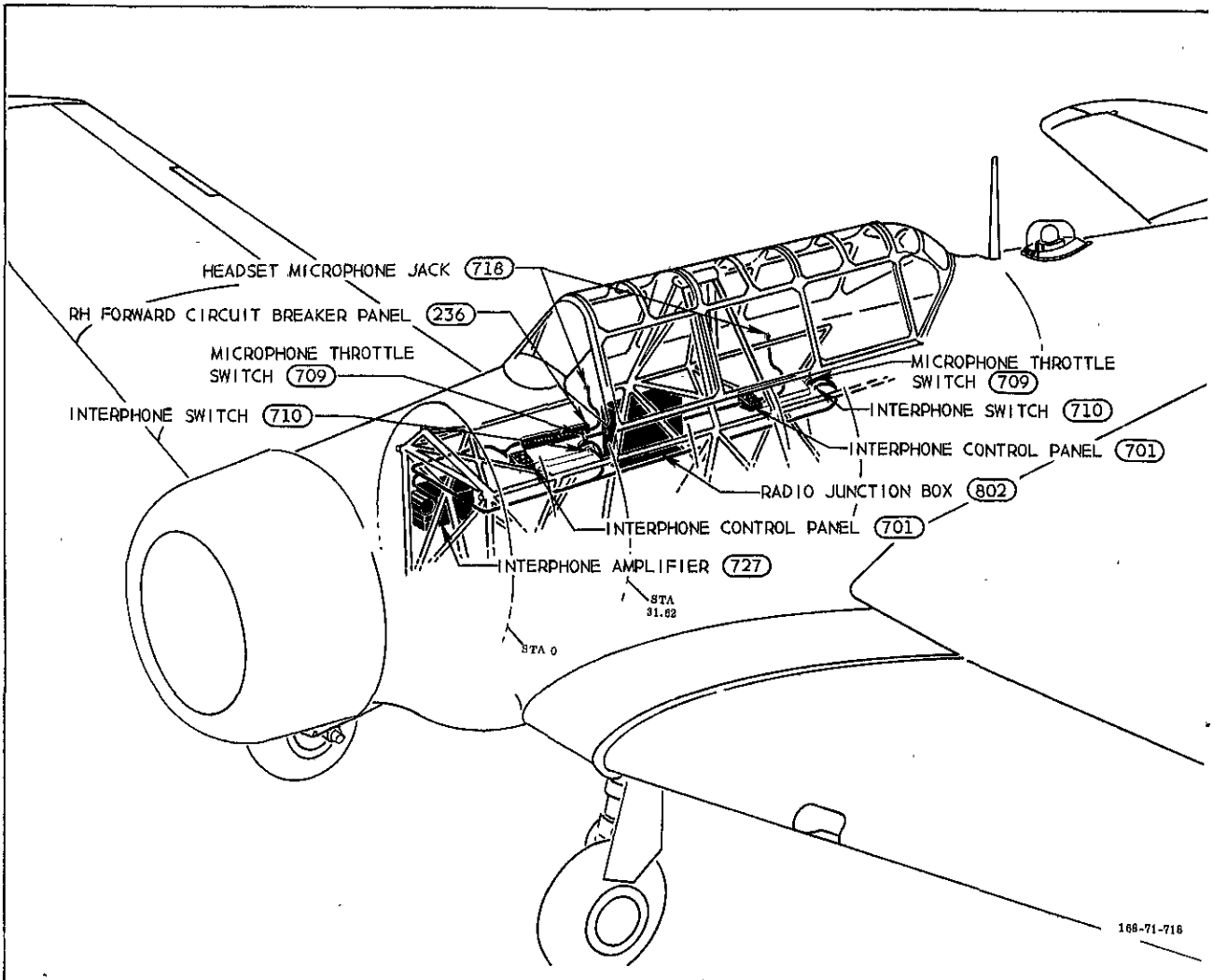


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Interphone Control	C-695/AIC
2	Panel - Radio Compass Control	C-404A/A, 159-71064-7 (NAA)
5	Mounting - Radio Compass Receiver	MT-278B/ARN-6
6	Receiver - Radio Compass	R-101A/ARN-6
38	Indicator - Radio Compass	ID-90/ARN-6
41	Circuit Breaker	AN3161-P5
47	Coupling - Tuning Shaft Tee	MC-203
48	Tuning Shaft	LA-1564
49	Tuning Shaft	LA-1564
50	Tuning Shaft	LA-1564
52	Plug	AN3108B-16S-1S
	* Electrical Item Number	

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
61	Plug	AN3106A-14S-2S
64	Plug	AN3106B-36-7S
65	Receptacle	AN3100A-36-7P
67	Adapter	AN3057-6
69	Adapter	AN3057-8
70	Adapter	AN3057-24
78	Antenna - Compass Sense	WS-5/U
79	Coupling Unit	CU-65/ARN-6
80	Cord - Sense Antenna	CG-405/ARN-6
81	Cord - Loop Antenna	CG-132/ARN-6
90	Terminal Strip	NAS45-6-( )
*226	Panel - Circuit Breaker	182-54027 (NAA)

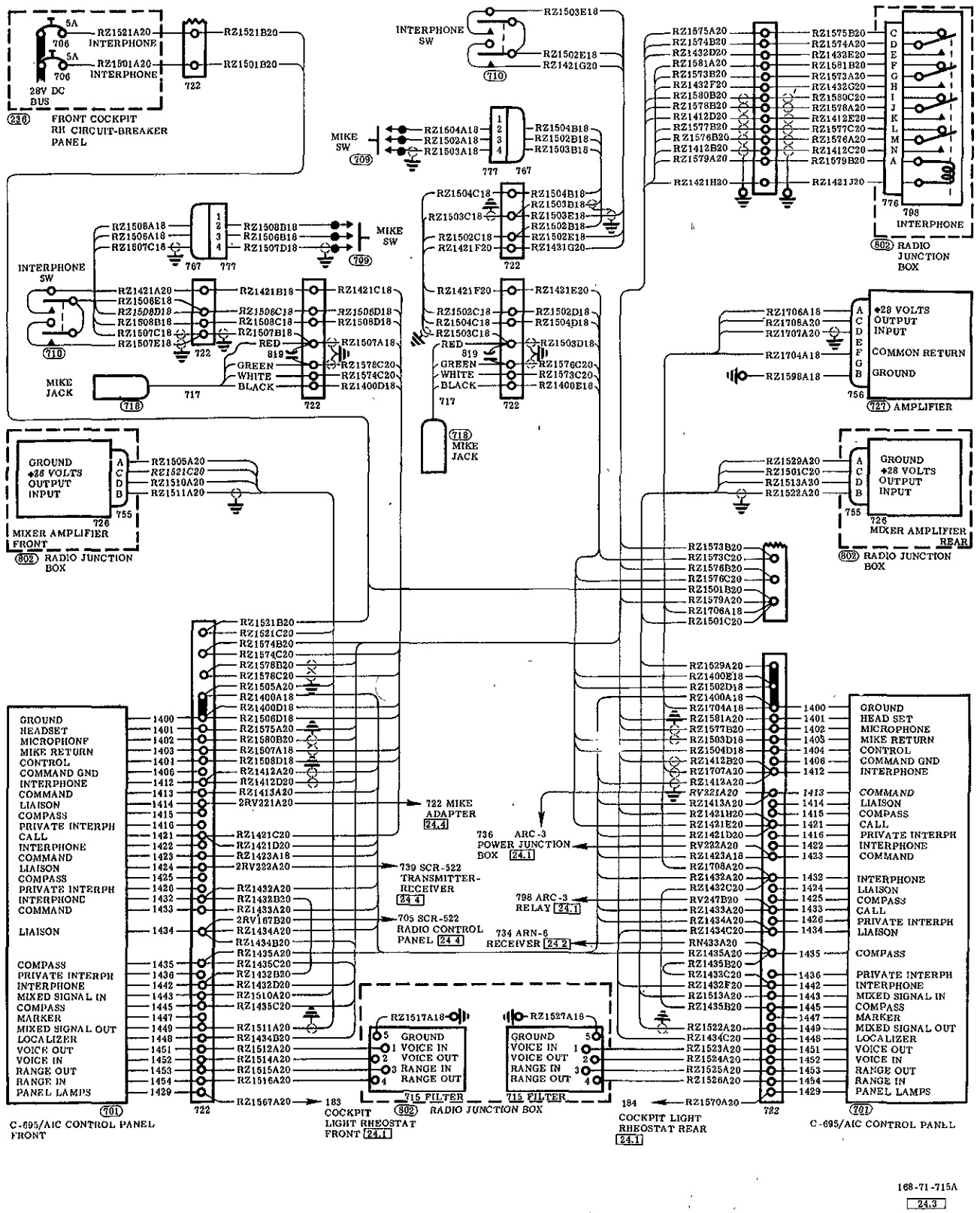
Figure 8-18A. AN/ARN-6 Radio Compass - Airplanes

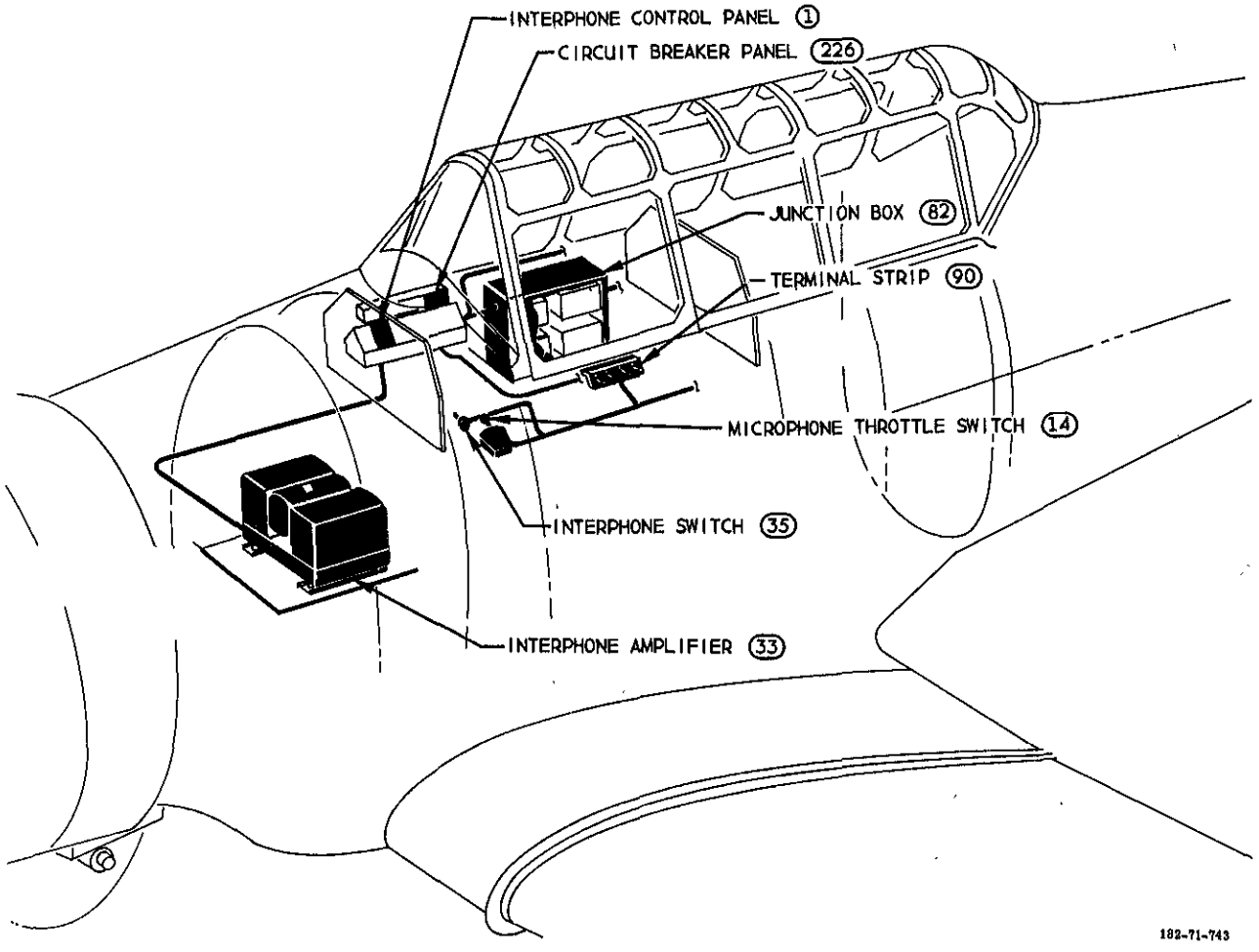

ID-90/ARN-6 INDICATOR FWD INST PANEL
RN445D20
RN448D20
RN446D20
RN447D20
COMPASS
5A
41
RN420A20
RN420B20
90
226 CIRCUIT BREAKER PANEL
ID-90/ARN-6 INDICATOR AFT INST PANEL
RN445B20
RN448B20
RN446B20
RN447B20
AUTOSYN PHASE 1
AUTOSYN PHASE 2
AUTOSYN PHASE 3
AUTOSYN POWER
MOTOR LO (Z) TERM 2
MOTOR LO (Z) TERM 1
MOTOR H (Z)
AS-313A/ARN-6 LOOP
AUDIO
INTERPHONE
COMMAND
LIAISON
COMPASS
PRIVATE INTE
MIXED SIGNAL
INTERPHONE
MIXED SIGNAL IN
COMPASS
MARKER
LOCALIZER
MIXED SIGNAL OUT
1435
1445
RZ1435A20
RZ1435C20
RZ1436C20
90
FWD CONSOLE
RN433B20
RZ1435A20
RZ1435B20
RZ1436B20
AFT CONSOLE
1 C-695/AIC CONTROL PANEL FWD CONSOLE
1 C-695/AIC CONTROL PANEL AFT CONSOLE
L45A20
L45A20 (REF)
RN489A20
28V DC CIRCUIT BREAKER PANEL DC POWER DISTRIBUTION
TUNING METER 460 RN460B20
CW SWITCH 461 RN461B20
PILOT LAMP 462 RN462B20
LOOP RELAY 463 RN463B20
BAND I 464 RN464B20
ANTENNA RELAY 465 RN465B20
SENS CONTROL 466 RN466B20
28 VOLTS IN 467 RN467B20
BAND II 468 RN468B20
28VOLTS OUT 469 RN469B20
AUDIO OUT 470 RN470B20
AUDIO IN 471 RN471B20
GROUND 472 RN472A20N
CONTROL SW 473 RN473B20
BAND III 474 RN474B20
LOOP MOTOR SW 475 RN475B20
LEFT ROTATION 476 RN476B20
RIGHT ROTATION 477 RN477B20
BAND IV 478 RN478B20
PANEL LAMPS 489 RN489A20
2 C-403A/A CONTROL PANEL FWD CONSOLE
L46A20 (REF)
RN499A20
28 VOLTS DC CIRCUIT BREAKER PANEL DC POWER DISTRIBUTION
PANEL LAMPS 489 RN499A20
TUNING METER 460 RN460B20
CW SWITCH 461 RN461B20
PILOT LAMP 462 RN462B20
LOOP RELAY 463 RN463B20
BAND I 464 RN464B20
ANTENNA RELAY 465 RN465B20
SENS CONTROL 466 RN466B20
28 VOLTS OUT 467 RN467B20
BAND II 468 RN468B20
28 VOLTS OUT 469 RN469B20
AUDIO OUT 470 RN410B20
AUDIO IN 471 RN411B20
GROUND 472 RN412A20N
CONTROL SW 473 RN413B20
BAND III 474 RN414B20
LOOP MOTOR SW 475 RN415B20
LEFT ROTATION 476 RN416B20
RIGHT ROTATION 477 RN417B20
BAND IV 478 RN418B20
2 C-403A/A CONTROL PANEL AFT CONSOLE
R-101A/ARN-6 RECEIVER
C24.2
182-71-739



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
236	Panel - Forward Right-hand Circuit Breaker	168-54082 (NAA)
701	Panel - Interphone Control	C-695/AIC
709	Switch - Microphone Throttle	C-1006
710	Switch - Interphone	AN3023-6
715	Filter	F-21/ARA-9
717	Microphone Cord Headset	WF-5/U
718	Microphone Jack Headset	U-61/U
722	Terminal Strip	NAS45-6
726	Amplifier - Interphone Mixer	AM-142/AIC
727	Amplifier - Interphone	AM-300/AIC
755	Plug	AN3108B-14S-2S
756	Plug	AN3106A-16S-1S
767	Plug	PL-108
776	Receptacle	AN3102M-20-27S
777	Receptacle - Throttle Quadrant	UG 58/U
798	Relay	8979-1A
802	Junction Box	168-71078 (NAA)

Figure 8-19. Interphone System -

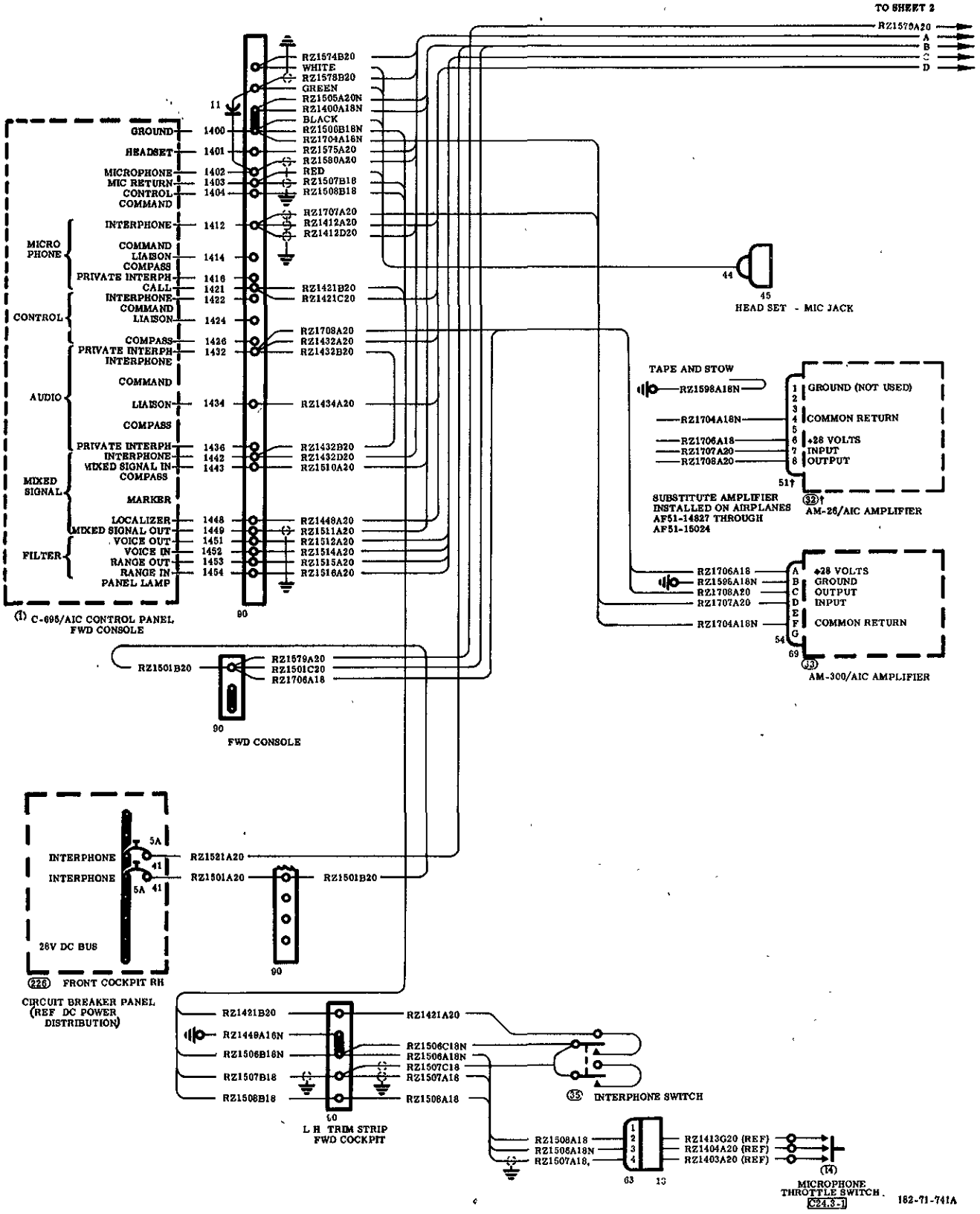

5A
706
RZ1521A20
INTERPHONE
RZ1521B20
5A
706
RZ1501A20
INTERPHONE
RZ1501B20
28V DC BUS
722
220 FRONT COCKPIT RH CIRCUIT-BREAKER PANEL
INTERPHONE SW
RZ1503E18
RZ1502E18
RZ1421G20
710
MIKE SW
709
RZ1504A18
RZ1502A18
RZ1503A18
RZ1504B18
RZ1502B18
RZ1503B18
777
767
RZ1575A20
RZ1574B20
RZ1432D20
RZ1581A20
RZ1573B20
RZ1432F20
RZ1580B20
RZ1578B20
RZ1412D20
RZ1577B20
RZ1576B20
RZ1412B20
RZ1579A20
RZ1421H20
RZ1575B20
RZ1574A20
RZ1432E20
RZ1581B20
RZ1573A20
RZ1432G20
RZ1580C20
RZ1578A20
RZ1412E20
RZ1577C20
RZ1576A20
RZ1412C20
RZ1579B20
RZ1421J20
776
708 INTERPHONE
802 RADIO JUNCTION BOX
RZ1504C18
RZ1503C18
RZ1502C18
RZ1421F20
RZ1504B18
RZ1503B18
RZ1503E18
RZ1502B18
RZ1502E18
RZ1421G20
722
RZ1508A18
RZ1506A18
RZ1507C18
RZ1508B18
RZ1506B18
RZ1507D18
767
777
MIKE SW
709
INTERPHONE SW
RZ1421A20
RZ1506E18
RZ1508D18
RZ1508B18
RZ1507C18
RZ1507E18
710
722
RZ1421B18
RZ1506C18
RZ1508C18
RZ1507B18
RED
819
GREEN
WHITE
BLACK
RZ1421C18
RZ1506D18
RZ1508D18
RZ1507A18
RZ1578C20
RZ1574C20
RZ1400D18
MIKE JACK
718
717
722
RZ1421F20
RZ1502C18
RZ1504C18
RZ1503C18
RED
819
GREEN
WHITE
BLACK
RZ1421E20
RZ1502D18
RZ1504D18
RZ1503D18
RZ1576C20
RZ1573C20
RZ1400E18
717
722
718 MIKE JACK
RZ1706A18
RZ1706A20
RZ1707A20
RZ1704A18
RZ1598A18
A
C
D
E
F
G
B
+28 VOLTS OUTPUT INPUT
COMMON RETURN
GROUND
756
727 AMPLIFIER
GROUND
+28 VOLTS
OUTPUT
INPUT
A
C
D
B
RZ1505A20
RZ1521C20
RZ1510A20
RZ1511A20
726
755
MIXER AMPLIFIER FRONT
802 RADIO JUNCTION BOX
RZ1529A20
RZ1501C20
RZ1513A20
RZ1522A20
A
C
D
B
GROUND
+28 VOLTS
OUTPUT
INPUT
755
726
MIXER AMPLIFIER REAR
802 RADIO JUNCTION BOX
RZ1573B20
RZ1573C20
RZ1576B20
RZ1576C20
RZ1501B20
RZ1579A20
RZ1706A18
RZ1501C20
RZ1521B20
RZ1521C20
RZ1574B20
RZ1574C20
RZ1578B20
RZ1578C20
RZ1505A20
RZ1400A18
RZ1400D18
RZ1506D18
RZ1575A20
RZ1580B20
RZ1507A18
RZ1508D18
RZ1412A20
RZ1412D20
RZ1413A20
2RV221A20
RZ1421C20
RZ1421D20
RZ1423A18
2RV222A20
RZ1432A20
RZ1432B20
RZ1433A20
2RV167B20
RZ1434A20
RZ1434B20
RZ1435A20
RZ1435C20
RZ1432B20
RZ1432D20
RZ1510A20
RZ1435C20
RZ1511A20
RZ1434B20
RZ1512A20
RZ1514A20
RZ1515A20
RZ1516A20
RZ1567A20
GROUND 1400
HEADSET 1401
MICROPHONE 1402
MIKE RETURN 1403
CONTROL 1404
COMMAND GND 1406
INTERPHONE 1412
COMMAND 1413
LIAISON 1414
COMPASS 1415
PRIVATE INTERPH 1416
CALL 1421
INTERPHONE 1422
COMMAND 1423
LIAISON 1424
COMPASS 1425
PRIVATE INTERPH 1426
INTERPHONE 1432
COMMAND 1433
LIAISON 1434
COMPASS 1435
PRIVATE INTERPH 1436
INTERPHONE 1442
MIXED SIGNAL IN 1443
COMPASS 1445
MARKER 1447
MIXED SIGNAL OUT 1449
LOCALIZER 1448
VOICE OUT 1451
VOICE IN 1452
RANGE OUT 1453
RANGE IN 1454
PANEL LAMPS 1429
701
722
C-695/AIC CONTROL PANEL FRONT
722 MIKE ADAPTER 24.4
736 ARC-3 POWER JUNCTION BOX 24.1
739 SCR-522 TRANSMITTER-RECEIVER 24.4
798 ARC-3 RELAY 24.1
705 SCR-522 RADIO CONTROL PANEL 24.4
734 ARN-6 RECEIVER 24.2
RZ1517A18
RZ1527A18
5 GROUND
1 VOICE IN
2 VOICE OUT
3 RANGE IN
4 RANGE OUT
715 FILTER
802 RADIO JUNCTION BOX
715 FILTER
GROUND 5
VOICE IN 1
VOICE OUT 2
RANGE IN 3
RANGE OUT 4
183
COCKPIT LIGHT RHEOSTAT FRONT 24.1
RZ1529A20
RZ1400E18
RZ1502D18
RZ1400A18
RZ1704A18
RZ1581A20
RZ1577B20
RZ1503D18
RZ1504D18
RZ1412B20
RZ1707A20
RZ1412A20
RV221A20
RZ1413A20
RZ1421H20
RZ1421E20
RZ1421D20
RV222A20
RZ1423A18
RZ1708A20
RZ1432A20
RZ1432C20
RV247B20
RZ1433A20
RZ1434A20
RZ1434C20
RN433A20
RZ1435A20
RZ1435B20
RZ1433C20
RZ1432F20
RZ1513A20
RZ1435B20
RZ1522A20
RZ1434C20
RZ1523A20
RZ1524A20
RZ1525A20
RZ1526A20
RZ1570A20
1400 GROUND
1401 HEAD SET
1402 MICROPHONE
1403 MIKE RETURN
1404 CONTROL
1406 COMMAND GND
1412 INTERPHONE
1413 COMMAND
1414 LIAISON
1415 COMPASS
1421 CALL
1416 PRIVATE INTERPH
1422 INTERPHONE
1423 COMMAND
1432 INTERPHONE
1424 LIAISON
1425 COMPASS
1433 CALL
1426 PRIVATE INTERPH
1434 LIAISON
1435 COMPASS
1436 PRIVATE INTERPH
1442 INTERPHONE
1443 MIXED SIGNAL IN
1445 COMPASS
1447 MARKER
1449 MIXED SIGNAL OUT
1448 LOCALIZER
1451 VOICE OUT
1452 VOICE IN
1453 RANGE OUT
1454 RANGE IN
1429 PANEL LAMPS
184
722
701
COCKPIT LIGHT RHEOSTAT REAR 24.1
C-695/AIC CONTROL PANEL
168-71-715A
24.3



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Interphone Control	C-695/AIC
13	Receptacle - Throttle Quadrant	
14	Switch - Microphone Throttle	
†32	Amplifier - Interphone	AM-26/AIC
33	Amplifier - Interphone	AM-300/AIC
35	Switch - Interphone	AN3023-6
41	Circuit Breaker	AN3161-P5
44	Cord - Headset and Microphone	WF5/U
45	Cord - Microphone Jack	U61/U
†51	Plug	PL-152A
54	Plug	AN3108A-16S-1S
63	Plug	PL-108
69	Adapter	AN3057-8
82	Junction Box	168-71078-10
90	Terminal Strip	NAS45-6-( )
*226	Panel - Circuit Breaker	182-54027 (NAA)

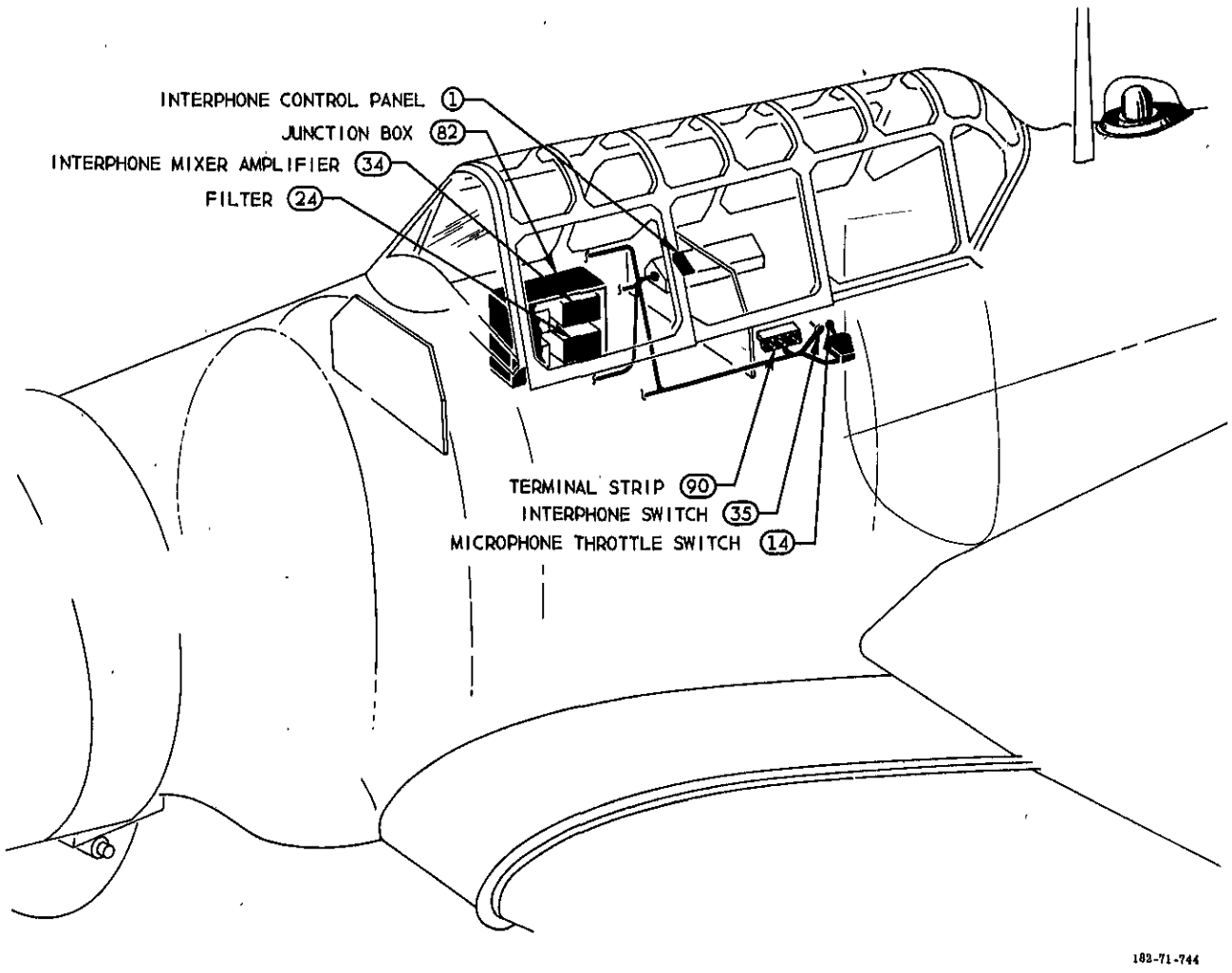
* Electrical Item Number

Figure 8-19A (Sheet 1 of 2 Sheets). Interphone System - Airplanes



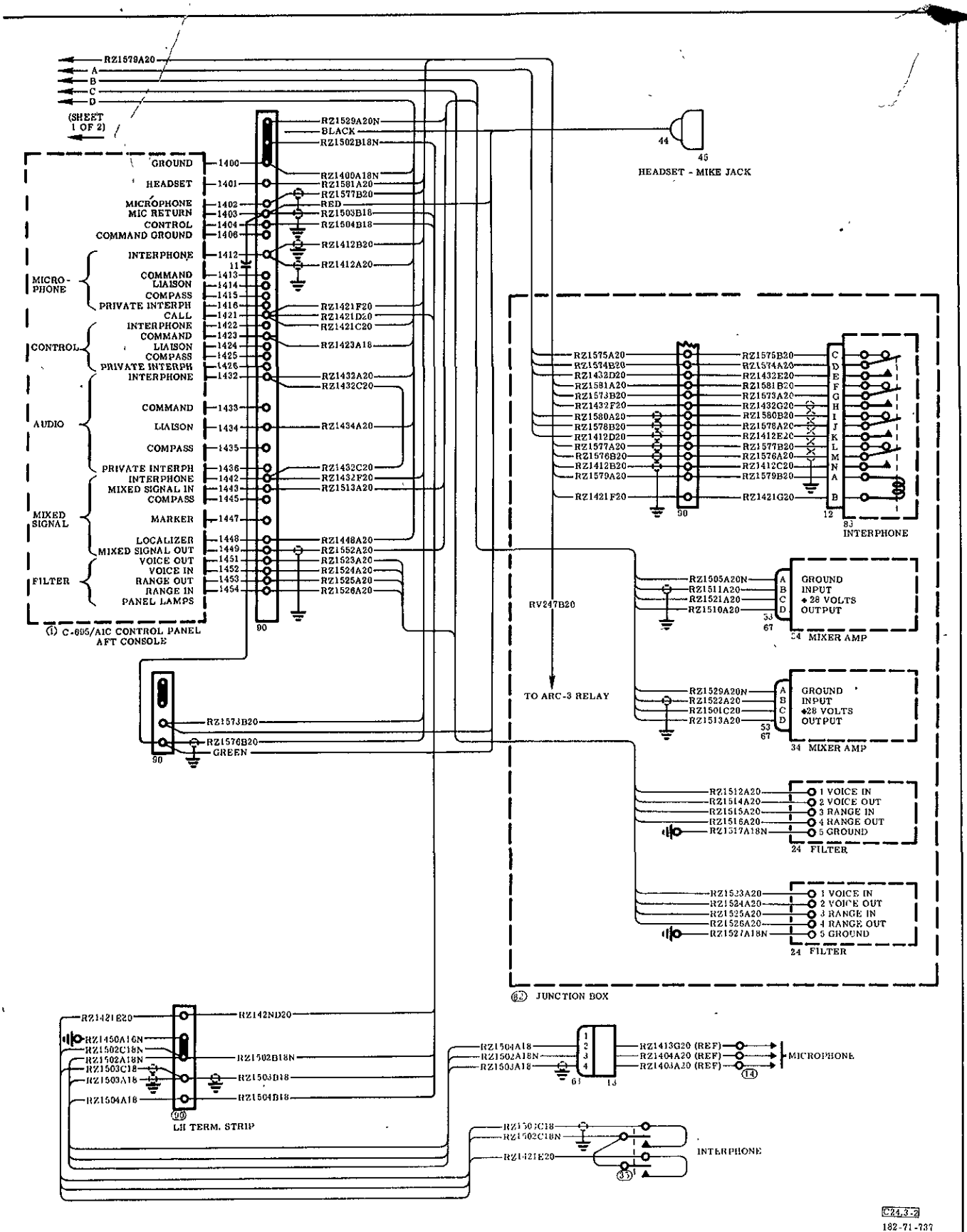
AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent

REVISED 25 JUNE 1953



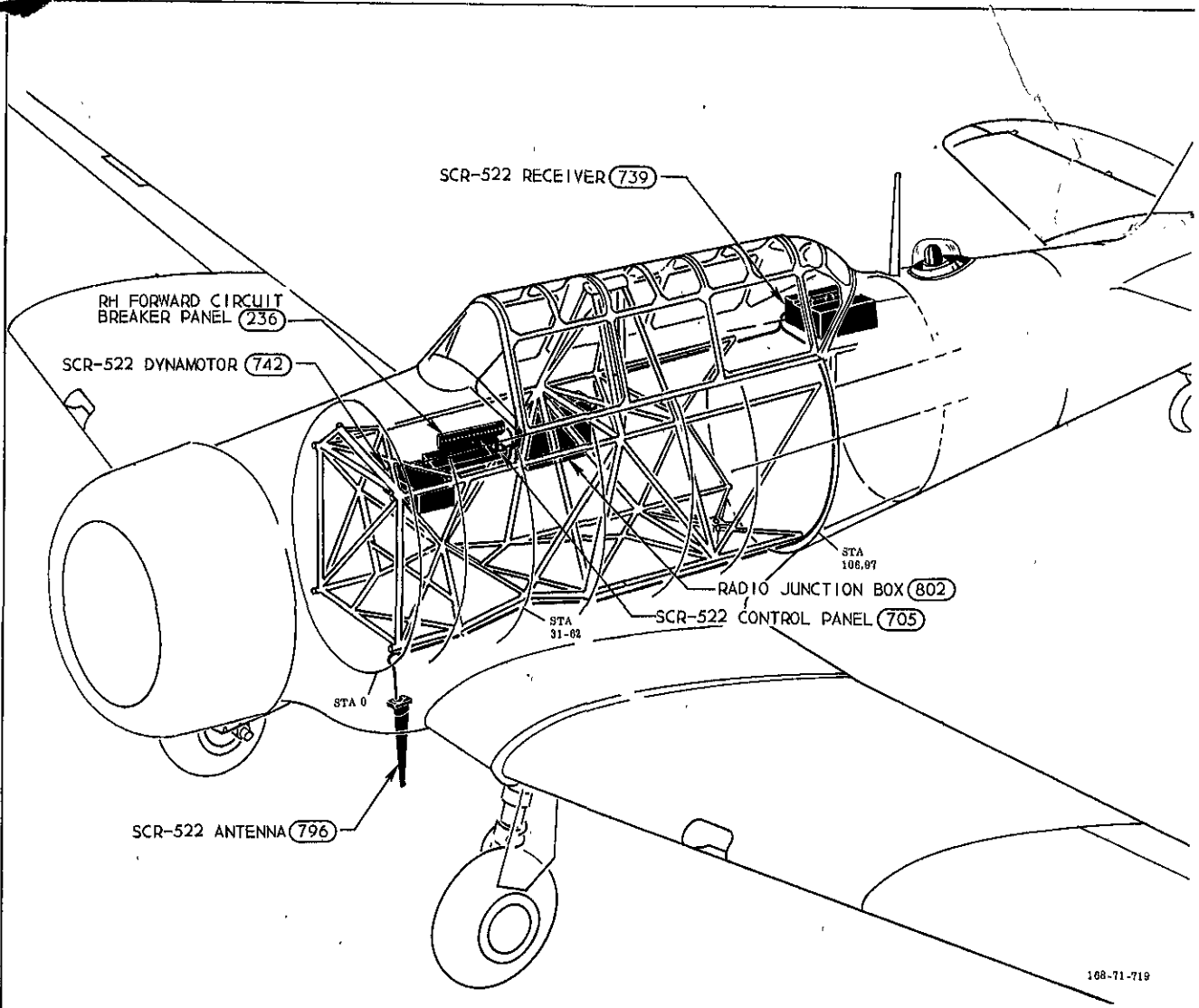
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Interphone Control	C-695/AIC
12	Receptacle	AN3102M-20-27S
13	Receptacle - Throttle Quadrant	
14	Switch - Microphone Throttle	
24	Filter	F-21/ARA-9
34	Amplifier - Interphone Mixer	AM-142/AIC
35	Switch - Interphone	AN3023-6
44	Cord - Headset and Microphone	WF5/U
45	Cord - Microphone Jack	U-61/U
53	Plug	AN3108B-14S-2S
63	Plug	PL-108
67	Adapter	AN3057-6
82	Junction Box	168-71078-10
83	Relay	8979-1A
90	Terminal Strip	NAS45-6-( )

Figure 8-19A (Sheet 2 of 2 Sheets). Interphone System - Airplanes



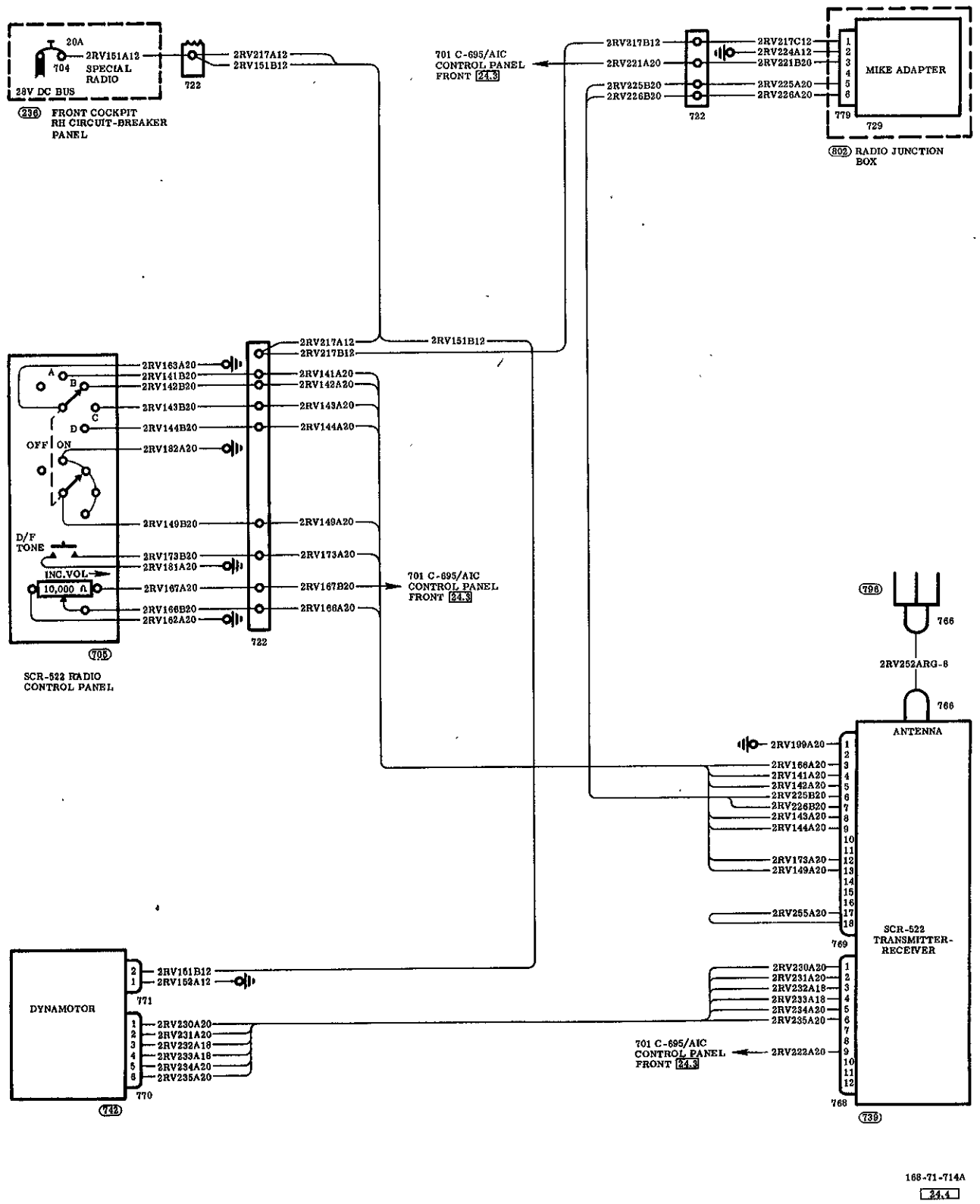
AF51-14314 Through AF51-15137, and AF51-17354 and Subsequent

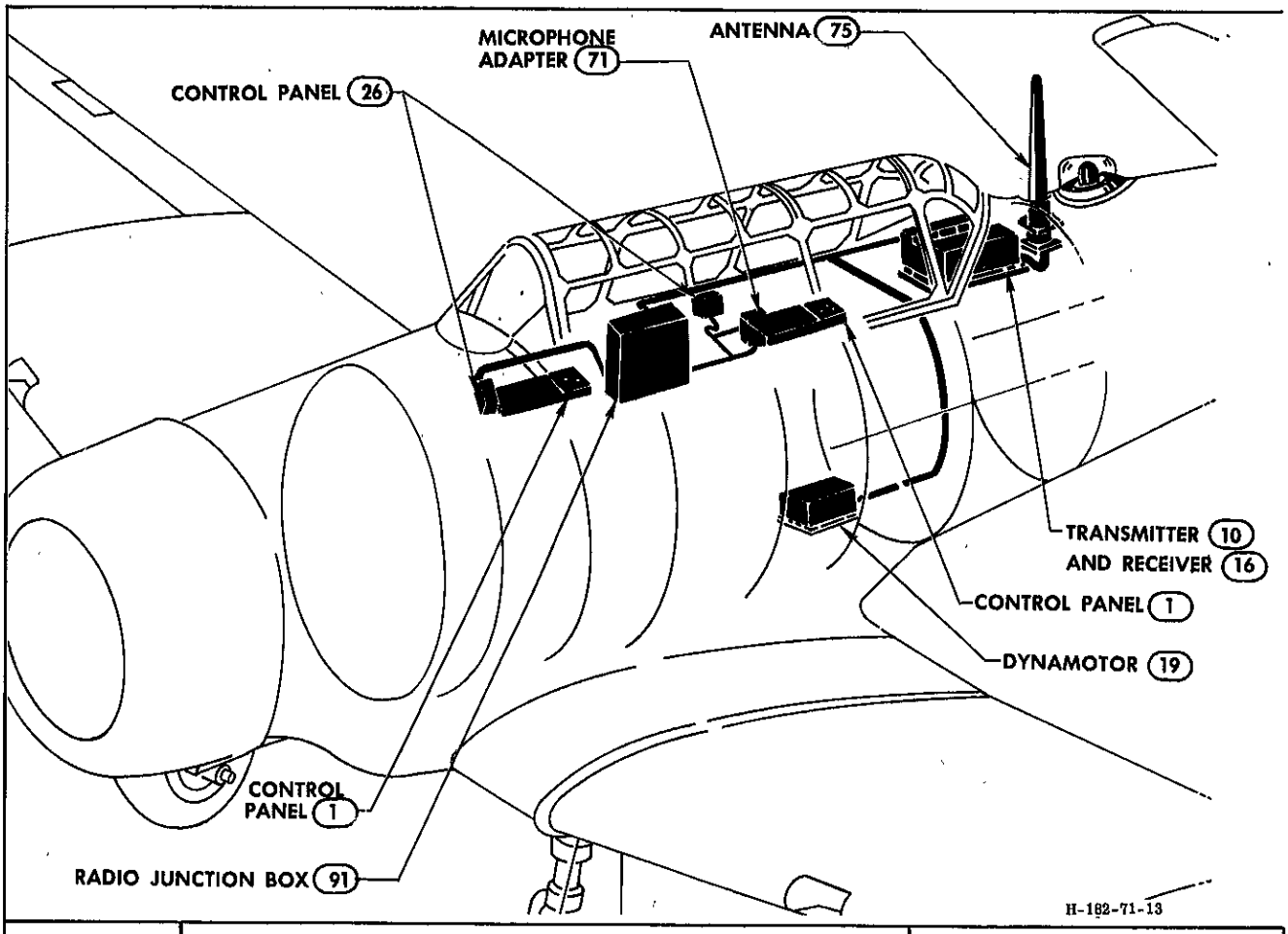
REVISED 25 JUNE 1953



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
705	Panel - Special Radio Control	168-71077 (NAA)
722	Terminal Strip	NAS45-6
739	Receiver - Special Radio	BC-624-C
742	Dynamotor - Special Radio	PE-94
766	Plug	PL-259-A
768	Plug	PL-Q-169
769	Plug	PL-Q-170
770	Plug	PL-Q-171
771	Plug	PL-Q-172
779	Socket	S306-CCT
796	Antenna - VHF/UHF	AN-104-B
802	Junction Box	168-71056 (NAA)

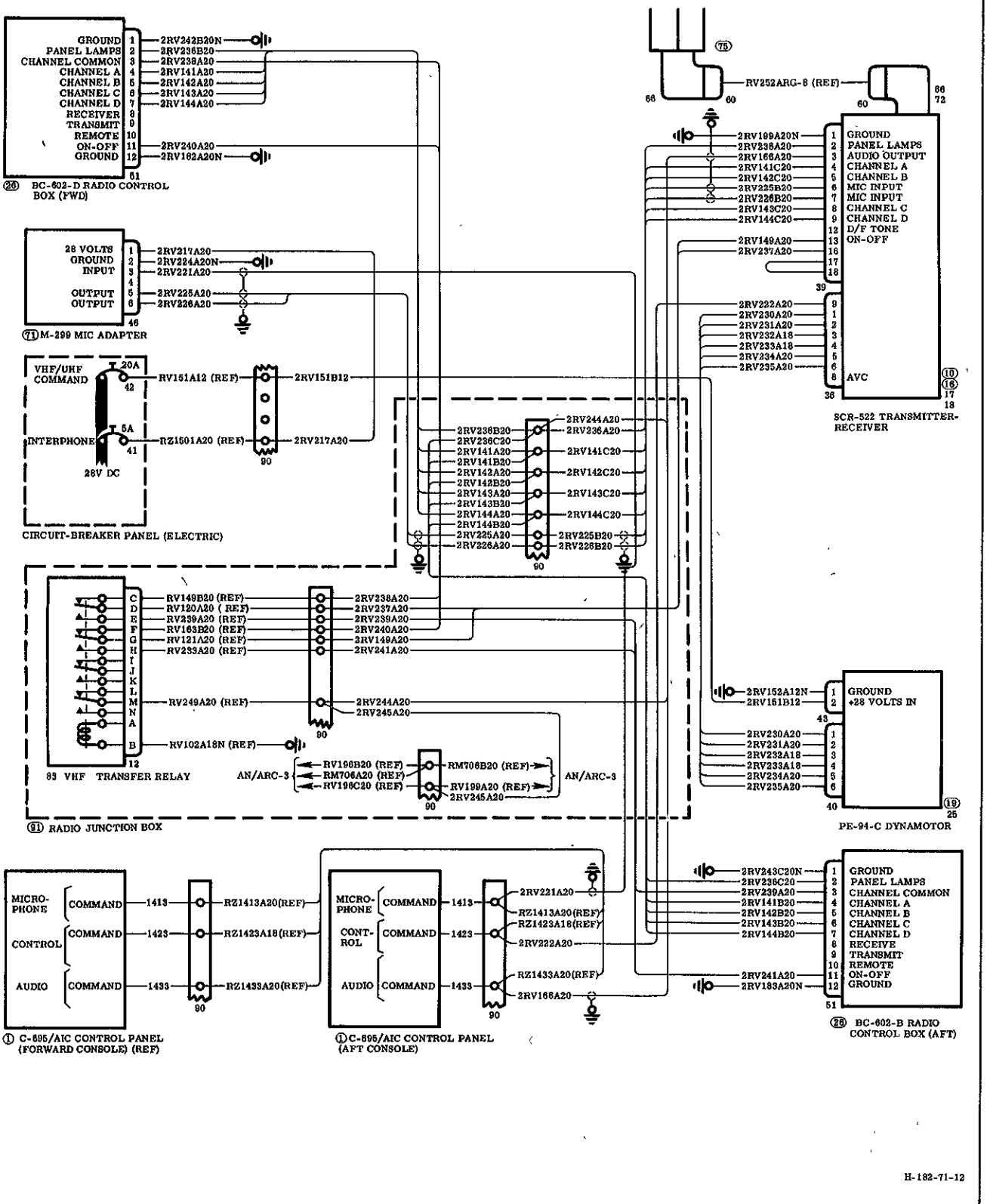
Figure 8-20. SCR-522 Radio -


20A
704
2RV151A12
SPECIAL RADIO
28V DC BUS
236
FRONT COCKPIT RH CIRCUIT-BREAKER PANEL
722
2RV217A12
2RV151B12
701 C-695/AIC CONTROL PANEL FRONT 24.3
2RV217B12
2RV221A20
2RV225B20
2RV226B20
2RV217C12
2RV224A12
2RV221B20
2RV225A20
2RV226A20
MIKE ADAPTER
779
729
802
RADIO JUNCTION BOX
2RV163A20
2RV141B20
2RV142B20
2RV143B20
2RV144B20
2RV182A20
2RV149B20
2RV173B20
2RV181A20
2RV167A20
2RV166B20
2RV162A20
OFF ON
D/F TONE
INC.VOL
10,000 Ω
2RV141A20
2RV142A20
2RV143A20
2RV144A20
2RV149A20
2RV173A20
2RV167B20
2RV166A20
705
SCR-522 RADIO CONTROL PANEL
798
766
2RV252ARG-6
ANTENNA
2RV199A20
2RV255A20
769
SCR-522 TRANSMITTER-RECEIVER
DYNAMOTOR
2RV161B12
2RV152A12
771
2RV230A20
2RV231A20
2RV232A18
2RV233A18
2RV234A20
2RV235A20
770
742
701 C-695/AIC CONTROL PANEL FRONT 24.3
2RV222A20
768
739
168-71-714A
24.4



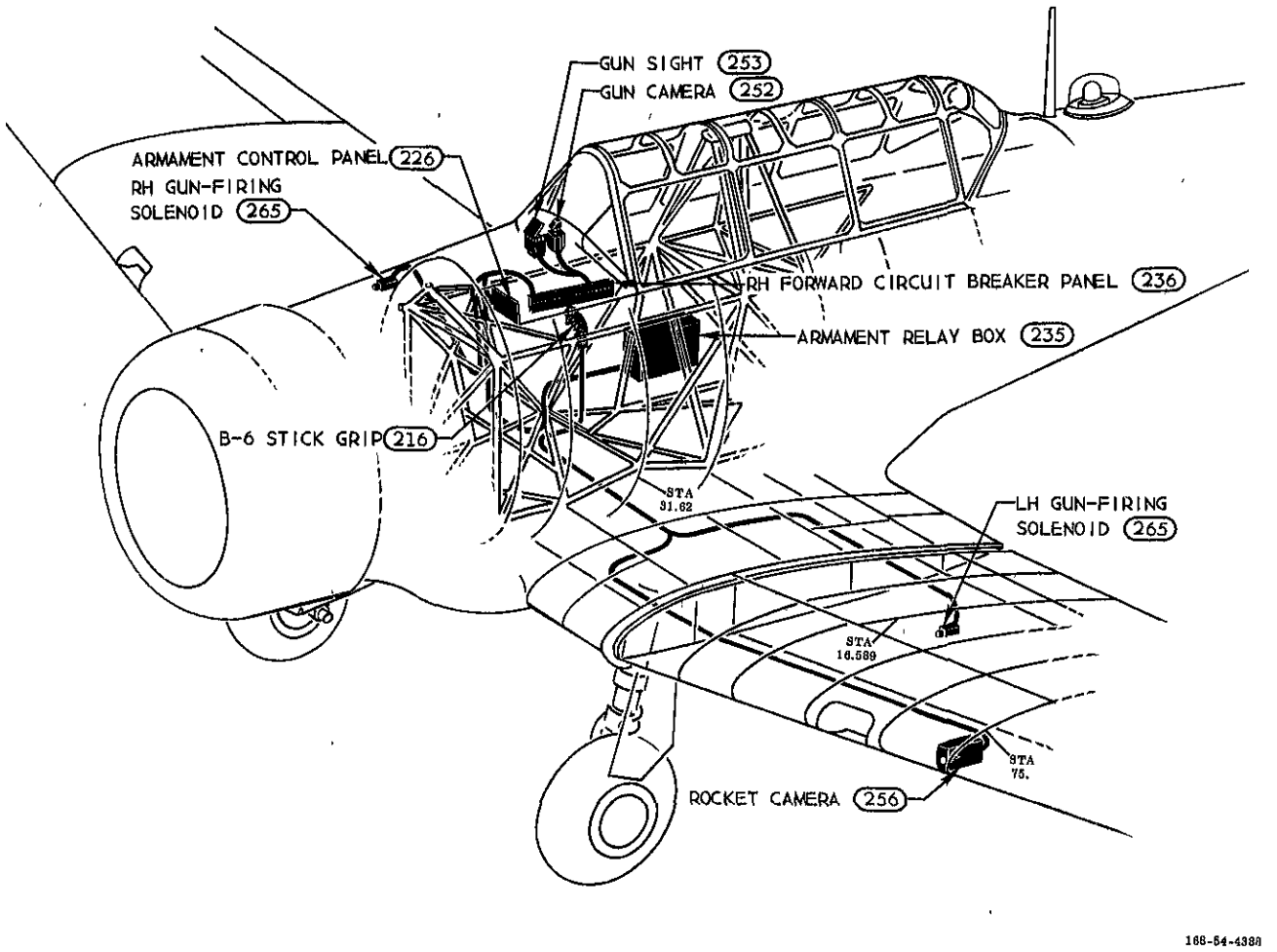
ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
1	Panel - Control	C-695/AIC
10	Transmitter (VHF)	BC-625AM
12	Receptacle	AN3102M-20-27S
16	Receiver (VHF)	BC-624-C
17	Mounting (CS-80-C)	FT-488
18	Rack (VHF Transmitter-receiver)	FT-244A
19	Dynamotor	PE-94-( )
25	Mounting (VHF Dynamotor)	FT-498
26	Box - Radio Control (VHF)	BC-602-( )
36	Plug	PL-Q-169
39	Plug	PL-Q-170
40	Plug	PL-Q-171
41	Circuit Breaker	AN3161P5
42	Circuit Breaker	AN3161P20
43	Plug	PL-Q-172
46	Socket	S306-CCT
51	Plug	PL-169
60	Plug	PL-259A
66	Adapter	M-359A
71	Adapter - Microphone	M-299
72	Adapter	PL-271
75	Antenna	AN-104-B
83	Relay - VHF Transfer	AN3303-1
90	Terminal Strip	NAS-45-6-(-7)
91	Junction Box	168-71056 (NAA)

Figure 8-20A. SCR-522A Radio -



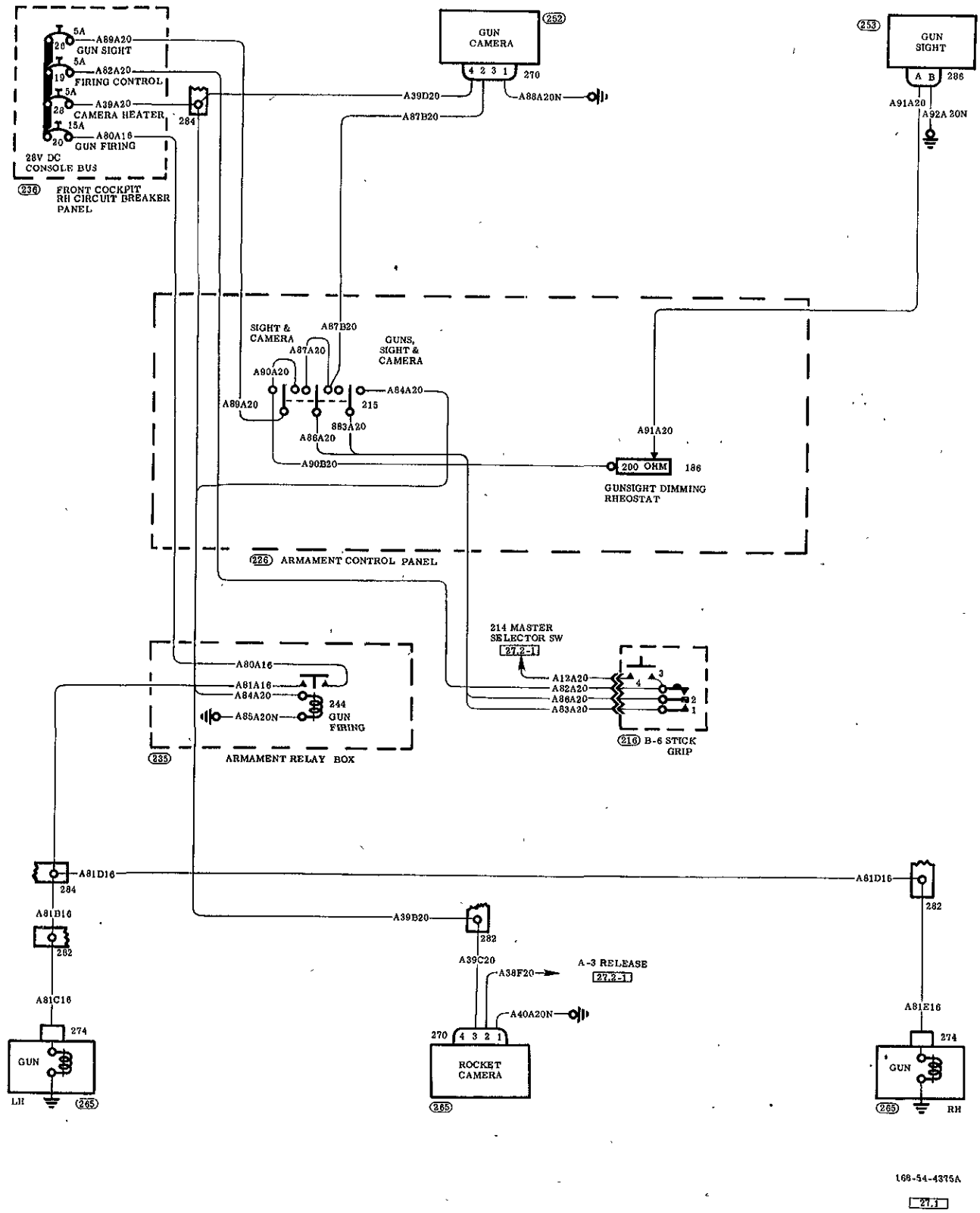
Airplanes AF51-14359 Through AF51-14683

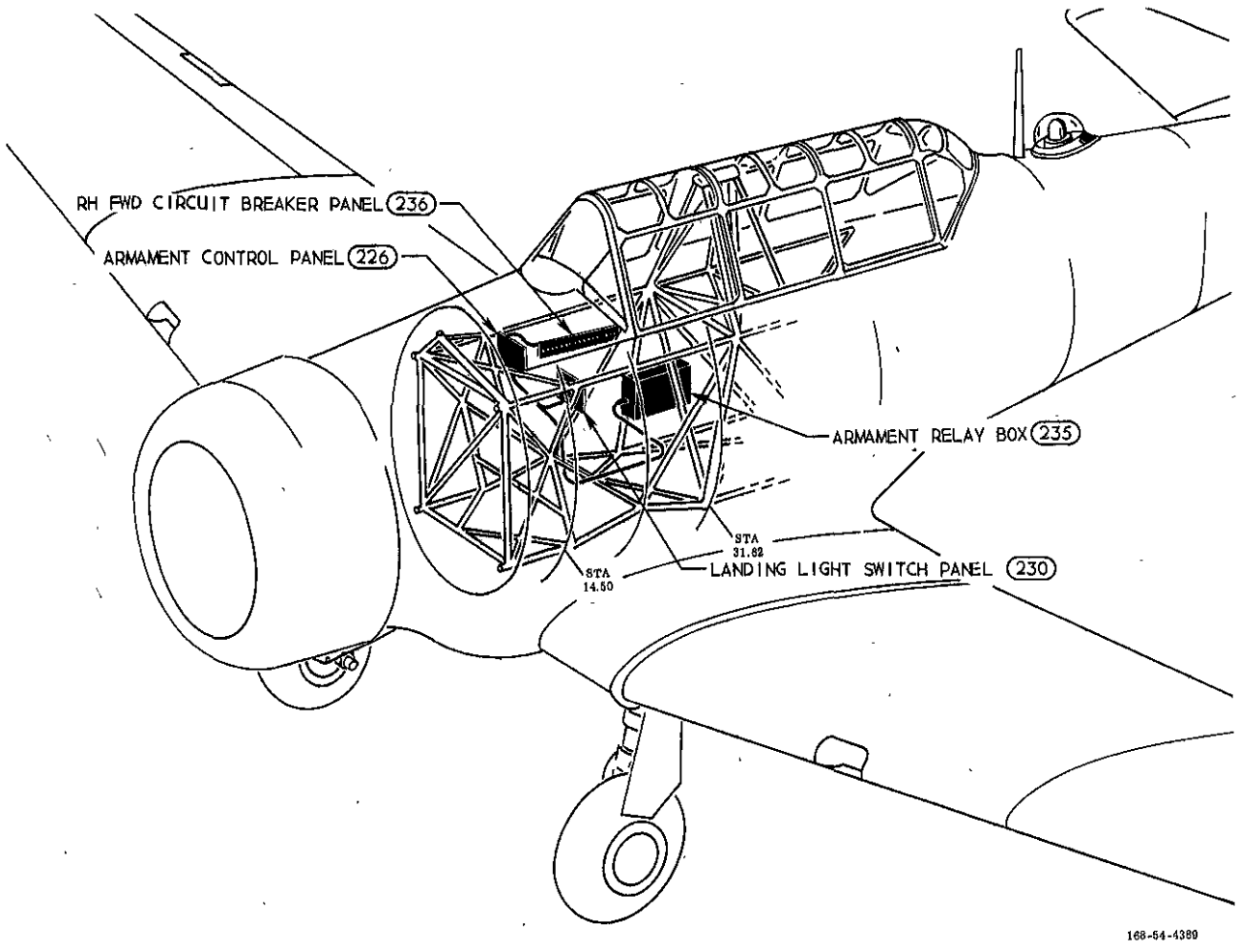
REVISED 15 JULY 1952



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
19	Circuit Breaker - Firing Controls	AN3161-P5
20	Circuit Breaker - Gun Firing	AN3161-P15
26	Circuit Breaker - Gun Sight	AN3161-P5
28	Circuit Breaker - Camera Heater	AN3161-P5
186	Rheostat - Gun Sight Dimming	AN3155-50-200
195	Switch - Gun Sight Filament Selector	AN3027-3
215	Switch - Gun Sight and Camera	AN3226-1
216	Switch - Trigger	B-6 24901
226	Control Box - Armament	168-54053 (NAA)
235	Relay Box - Electrical Armament	168-54086 (NAA)
236	Panel - Forward Right-hand Circuit Breaker	168-54082 (NAA)
244	Relay - Gun Firing	AN3320-1
252	Camera - Gun	N-6 171536
253	Sight - N3C Gun	
256	Rack	S-2
265	Solenoid - Gun Firing	G-9 93-24706
270	Plug	102-C (Burton)
274	Receptacle	AN3106-10S-2S
282	Terminal Strip	AN34-2-20
284	Terminal Strip	
286	Plug - Gun Sight	AN3102-12-3S
288	Receptacle - Gun Sight	

Figure 8-21. Gun Sight and Camera -

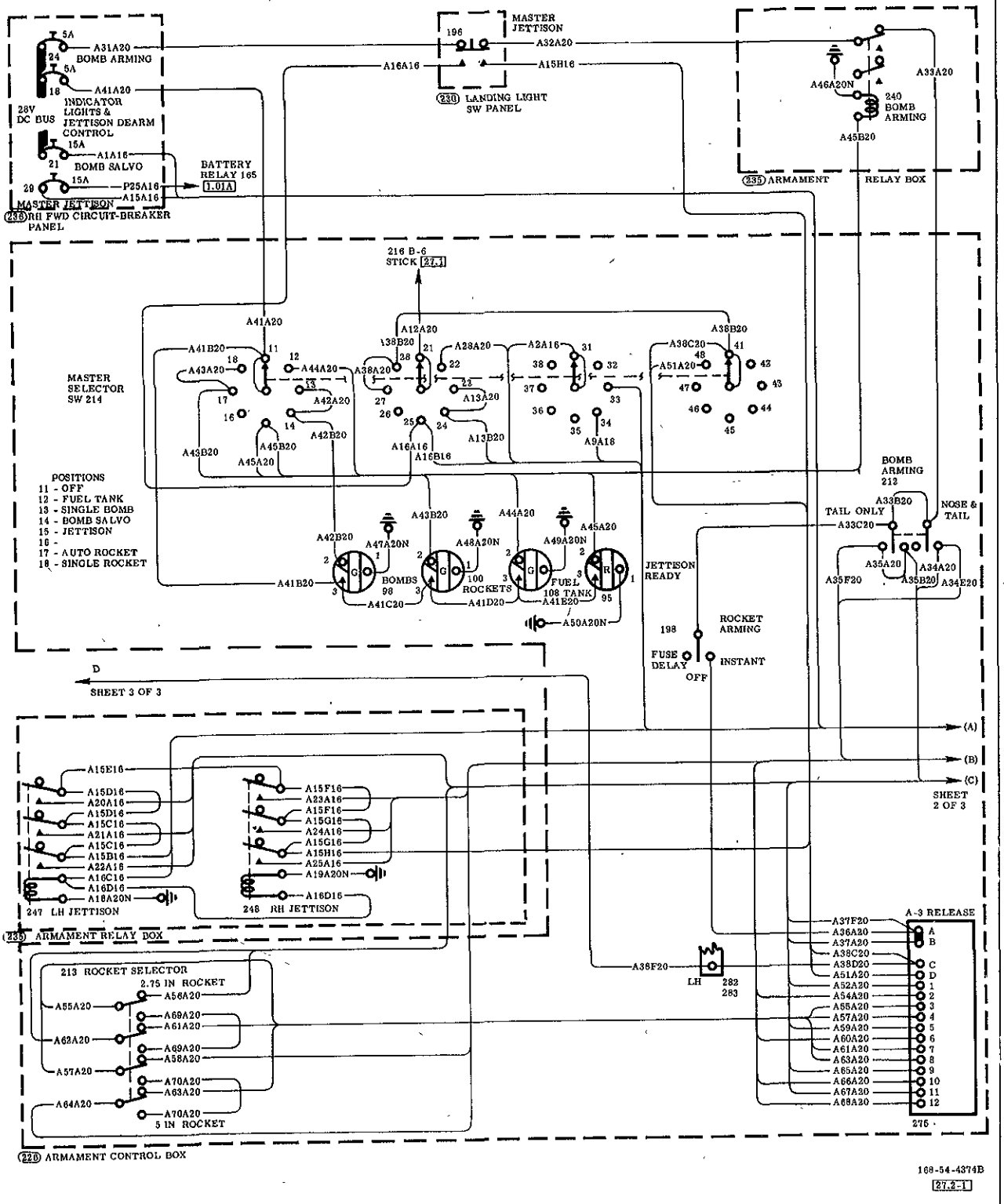

5A
20
A89A20
GUN SIGHT
5A
19
A82A20
FIRING CONTROL
5A
28
A39A20
CAMERA HEATER
15A
20
A80A16
GUN FIRING
28V DC
CONSOLE BUS
236
FRONT COCKPIT
RH CIRCUIT BREAKER
PANEL
284
GUN
CAMERA
252
4 2 3 1
270
A39D20
A87B20
A88A20N
GUN
SIGHT
253
A B
286
A91A20
A92A20N
SIGHT &
CAMERA
A87B20
A87A20
GUNS,
SIGHT &
CAMERA
A90A20
A89A20
A84A20
215
A83A20
A86A20
A90B20
A91A20
200 OHM
186
GUNSIGHT DIMMING
RHEOSTAT
226 ARMAMENT CONTROL PANEL
214 MASTER
SELECTOR SW
27.2-1
A80A16
A81A16
A84A20
A85A20N
244
GUN
FIRING
235
ARMAMENT RELAY BOX
A12A20
A82A20
A86A20
A83A20
216 B-6 STICK
GRIP
A81D16
284
A81D16
282
A81B16
282
A39B20
282
A39C20
A38F20
A-3 RELEASE
27.2-1
A40A20N
A81C16
274
GUN
LH
265
270 4 3 2 1
ROCKET
CAMERA
265
A81E16
274
GUN
265
RH
166-54-4375A
27.1

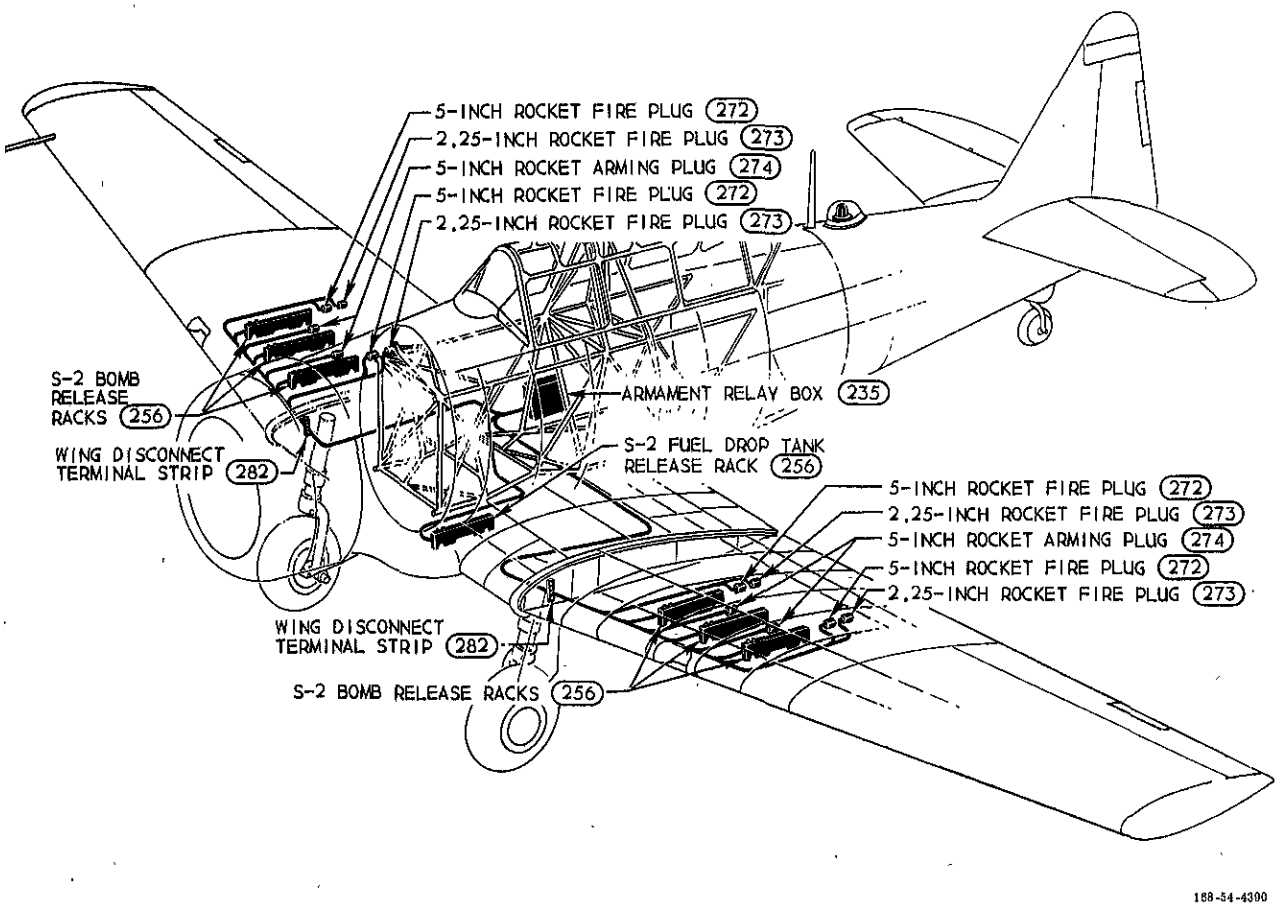


ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
18	Circuit Breaker - Indicator Lights and Jettison Dearming Control	AN3161-P5
21	Circuit Breaker - Bomb Salvo	AN3161-P15
24	Circuit Breaker - Bomb Arming	AN3161-P5
29	Circuit Breaker - Master Jettison	AN3161-P15
95	Light Assembly - Jettison Ready	AN3157-3
98	Light Assembly - Bombs Ready	AN3157-3
100	Light Assembly - Rockets Ready	AN3157-3
108	Light Assembly - Fuel Tank Ready	AN3157-3
198	Switch - Rocket Arming	AN3021-1
212	Switch - Bomb Arming	AN3027-1
213	Switch - Rocket Selector	AN3227-3

ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
214	Switch - Master Selector	AN3211-4
226	Control Box - Armament	168-54053 (NAA)
230	Box Assembly - Landing Gear Position Indicators	168-33523 (NAA)
235	Relay Box - Electrical Armament	168-54086 (NAA)
236	Panel - Forward Right-hand Circuit Breaker	168-54082 (NAA)
247	Relay - Left-hand Jettison	AN3316-1
248	Relay - Right-hand Jettison	AN3316-1
275	Control - Rocket Release	A-3 24975
282	Terminal Strip	AN34-2-20
283	Terminal Strip	AN34-2-5

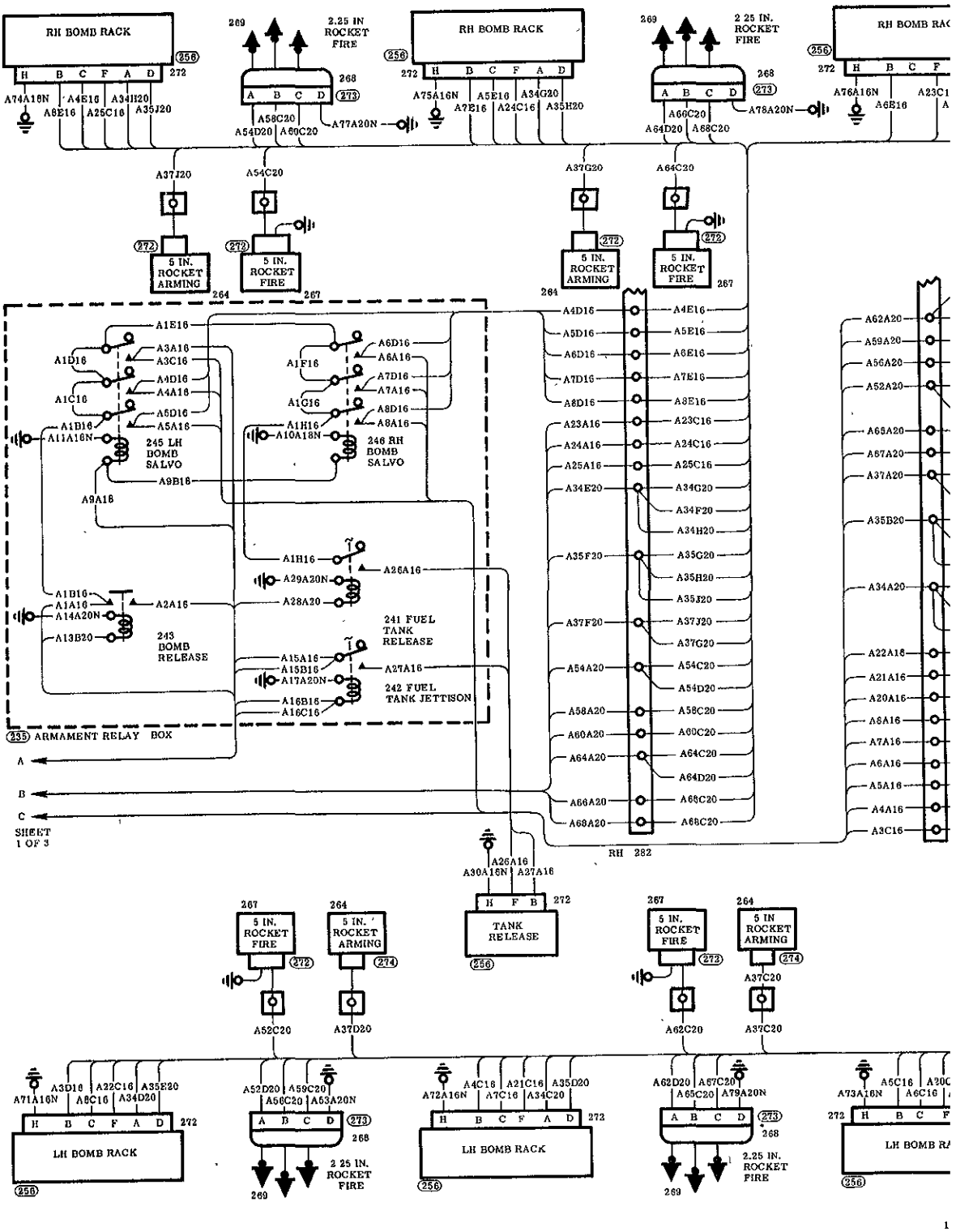
Figure 8-22 (Sheet 1 of 3 Sheets). Armament - Airplanes

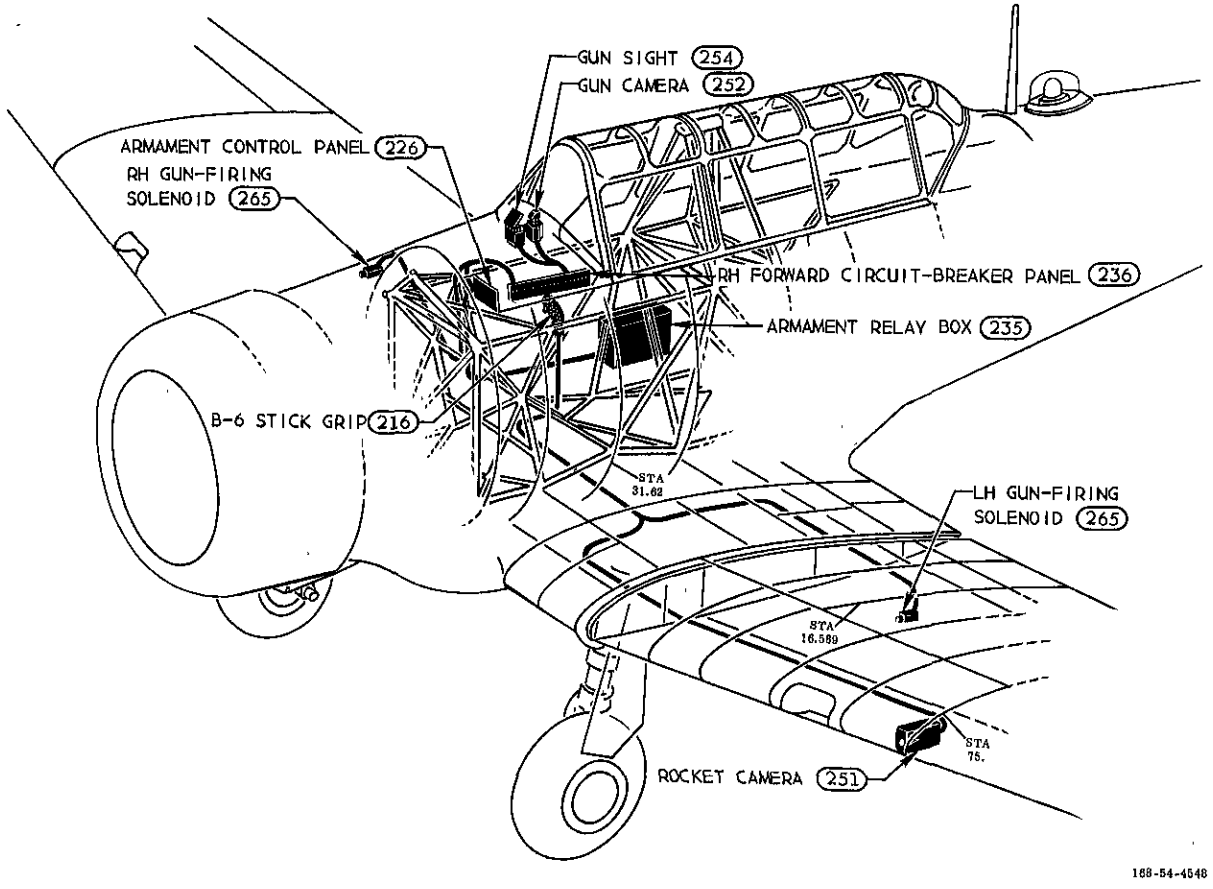

MASTER JETTISON
196
A32A20
A16A16
A15H16
230 LANDING LIGHT SW PANEL
A46A20N
A33A20
240 BOMB ARMING
A45B20
235 ARMAMENT RELAY BOX
5A
A31A20
24
BOMB ARMING
5A
18
A41A20
INDICATOR LIGHTS & JETTISON DEARM CONTROL
28V DC BUS
15A
A1A16
21
BOMB SALVO
15A
29
P25A16
A15A16
MASTER JETTISON
BATTERY RELAY 165 1.01A
236 RH FWD CIRCUIT-BREAKER PANEL
216 B-6 STICK 27.1
A41A20
A12A20
A38B20
A41B20
A43A20
A44A20
A38A20
A28A20
A2A16
A38C20
A51A20
A42A20
A13A20
A42B20
A45B20
A45A20
A16A16
A16B16
A13B20
A9A18
MASTER SELECTOR SW 214
POSITIONS
11 - OFF
12 - FUEL TANK
13 - SINGLE BOMB
14 - BOMB SALVO
15 - JETTISON
16 -
17 - AUTO ROCKET
18 - SINGLE ROCKET
A42B20
A47A20N
A43B20
A48A20N
A44A20
A49A20N
A45A20
A41B20
A41C20
A41D20
A41E20
A50A20N
BOMBS 98
100 ROCKETS
FUEL 108 TANK
95
JETTISON READY
198
ROCKET ARMING
FUSE
DELAY
INSTANT
OFF
BOMB ARMING 212
A33B20
TAIL ONLY
A33C20
NOSE & TAIL
A35A20
A34A20
A35F20
A35B20
A34E20
D
SHEET 3 OF 3
(A)
(B)
(C)
SHEET 2 OF 3
A15E16
A15D16
A20A16
A15D16
A15C16
A21A16
A15C16
A15B16
A22A16
A16C16
A16D16
A18A20N
247 LH JETTISON
A15F16
A23A16
A15F16
A15G16
A24A16
A15G16
A15H16
A25A16
A19A20N
A16D16
248 RH JETTISON
235 ARMAMENT RELAY BOX
A38F20
LH
282
283
A-3 RELEASE
A37F20
A36A20
A37A20
A38C20
A38D20
A51A20
A52A20
A54A20
A55A20
A57A20
A59A20
A60A20
A61A20
A63A20
A65A20
A66A20
A67A20
A68A20
A
B
C
D
1
2
3
4
5
6
7
8
9
10
11
12
275
213 ROCKET SELECTOR
2.75 IN ROCKET
A55A20
A56A20
A69A20
A61A20
A62A20
A69A20
A58A20
A57A20
A70A20
A63A20
A64A20
A70A20
5 IN ROCKET
220 ARMAMENT CONTROL BOX
168-54-4374B
27.2-1



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
241	Relay - Fuel Tank Release	237EAU (Leach)
242	Relay - Fuel Tank Jettison	237EAU (Leach)
243	Relay - Bomb Release	AN3320-1
245	Relay - Left-hand Bomb Salvo	AN3316-1
246	Relay - Right-hand Bomb Salvo	AN3316-1
256	Rack	S-2
264	Solenoid - Arming	AN-A-2
267	Receptacle Assembly - Rocket Rear Mount	121-54413
268	Receptacle Assembly - Rocket Mount	AN3102-14S-2P
269	Socket - Rocket Igniter	Q 237 (Monowatt)
271	Receptacle	AN3102A-14S-2P
272	Receptacle	AN3100A-18-1S
273	Connector	AN3107A-14S-2S
274	Receptacle	AN3106-10S-2S
282	Terminal Strip	AN34-2-20
283	Terminal Strip	AN34-2-5

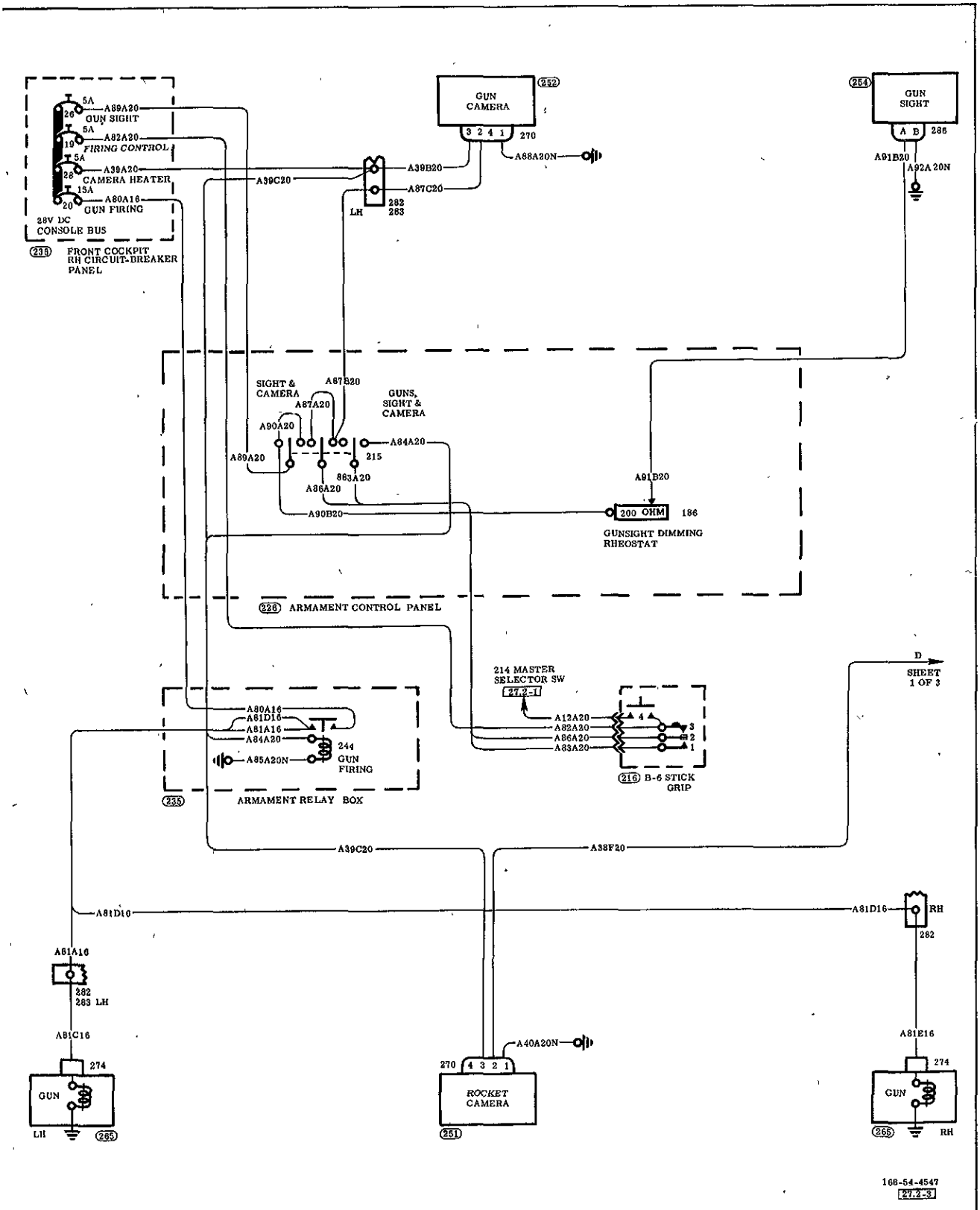
Figure 8-22 (Sheet 2 of 3 Sheets). Armament - Airplanes


RH BOMB RACK
2.25 IN ROCKET FIRE
5 IN. ROCKET ARMING
5 IN. ROCKET FIRE
245 LH BOMB SALVO
246 RH BOMB SALVO
241 FUEL TANK RELEASE
242 FUEL TANK JETTISON
243 BOMB RELEASE
235 ARMAMENT RELAY BOX
TANK RELEASE
LH BOMB RACK
SHEET 1 OF 3
RH 282



ITEM NO.	PART AND DESCRIPTION	TYPE OR DRAWING NO. OR MFR NAME AND NO.
19	Circuit Breaker - Firing Controls	AN3161-P5
20	Circuit Breaker - Gun Firing	AN3161-P15
26	Circuit Breaker - Gun Sight	AN3161-P5
28	Circuit Breaker - Camera Heater	AN3161-P5
186	Rheostat - Gun Sight Dimming	AN3155-50-200
215	Switch - Gun Sight and Camera	AN3226-1
216	Switch - Trigger	B-6 24901
226	Control Box - Armament	168-54053 (NAA)
235	Relay Box - Electrical Armament	168-54086 (NAA)
236	Panel - Forward Right-hand Circuit Breaker	168-54082 (NAA)
244	Relay - Gun Firing	AN3320-1
251	Camera - Rocket	N6-171536
254	Gun Sight - N-3C	
265	Solenoid - Gun Firing	G-9 93-24706
270	Plug	102-O (Burton)
274	Receptacle	AN3106-10S-2S
282	Terminal Strip	AN34-2-20
283	Terminal Strip	AN34-2-5
286	Plug - Gun Sight	AN3102-12-3S

Figure 8-22 (Sheet 3 of 3 Sheets). Armament - Airplanes



AF49-3188 Through AF49-3596 and AF50-1277 Through AF50-1326

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